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Nutritional Disturbances Upon Calcification and Decalcification of Teeth—*Marshall*

Utility of Radiography—*Simpson*

Cast Gold Abutment—*Argue*

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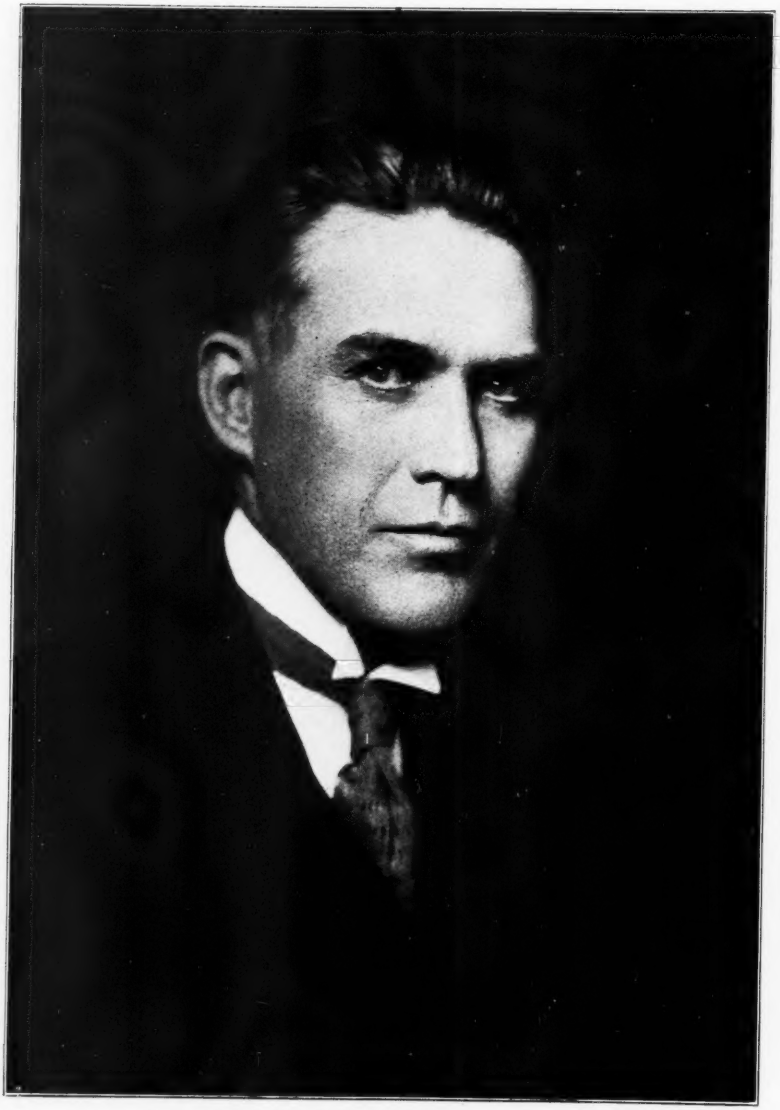

HONORABLE HENRIK SHIPSTEAD, D.D.S.
United States Senator from Minnesota

THE JOURNAL
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Original Communications

THE CANCER PROBLEM

By GEORGE W. CRILE, M.D., Cleveland, Ohio

(Read before the American Dental Association, Cleveland, Ohio, September 10-14, 1923)

WHILE the incidence of cancers of the buccal cavity cannot be compared with that of cancers of the stomach and intestines, or of the female genital organs, and while many of the cancers of this region are due to smoking, nevertheless, the fact is derived from recent tables by Hoffman that among 168 cases of buccal cancer the probable cause of 13 per cent was defective teeth, and that among this number were included forty-five cases of cancer of the jaw and mouth, of which 30 per cent could be traced to dental conditions. From these facts, one may readily see that the cancer problem is of direct significance to dental surgeons. Since common observation testifies to the influence of long continued irritations as one of the principal precancerous conditions, it is obvious that chronic irritation of the tongue and buccal cavity by decayed and ragged teeth or by ill-fitting crown and bridge work or dental plates cannot fail to be a distinct menace.

Among the significant statistics in this connection may be cited the comparative death rates from cancer per hundred thousand inhabitants of various countries, in which the highest incidence is in countries in which the condition of the teeth is known to be poor, whether through climatic conditions, dietary habits or the comparatively slight development of dental education. To my knowledge, no cancer of the cheek or of the mucous membranes of the buccal cavity has ever grown upon a normal, unmutilated, uninjured surface. I have never seen a cancer of the mouth in a perfectly sanitary mouth with normal teeth.

In general, we may conclude that the incidence of cancer in any part of the

body is usually, if not always, preceded by a distinctly precancerous condition; and in most instances this precancerous condition is remediable. If every chronic irritation were removed, if every chronic ulcer, wherever it is located, were healed or excised, if every wart or mole were removed and every keratosis cured, if the mouth were kept wholesome and the teeth smooth, if unhealthy scar tissue were always removed and, if necessary, the surface covered by skin, probably then the problem of cancer of the cheek and the mouth would be measurably, if not completely, solved.

The precancerous conditions in the internal organs are in many instances no less amenable to treatment, but the problem in such cases is not so readily solved, as the preliminary symptoms of lesions of the internal organs are more readily masked.

In addition to the fact that precancerous conditions of the mouth and jaw can almost always be recognized and cured in their earliest stages, another interesting and hopeful feature of cancer of these parts is the fact that they do not readily metastasize to distant organs. In the case of cancer of the breast, for example, early dissemination through the lymphatic channels carries the cancer cells to other organs and tissues and the patient ultimately dies, not from the breast cancer but from metastasis in the liver or in the lungs. Cancer of the uterus, of the stomach or of the intestines also disseminates readily to other organs, but when death results from a cancer of the head or neck, it is because of local and regional development of the disease, not because of a distant invasion.

A study of the literature pertaining to cancer of the head and neck has shown that among 4,500 reported necropsies, in only 1 per cent were secondary foci found in distant organs or tissues. The collar of lymphatics about the neck forms an almost impassable barrier through which cancer rarely penetrates; and every portion of this barrier is readily accessible to the surgeon. After the lymphatic stream has been blocked by carcinomatous invasion, it may flow in any direction, and every sort of irregularity in the further metastases may follow, but the metastases will still remain within the accessible lymphatic collar.

As far as metastatic dissemination is concerned, therefore, cancer of the head and neck presents a far more favorable outlook than does cancer of the breast with its thoracic and abdominal metastases, or cancer of the stomach or intestines with its inaccessible retroperitoneal and liver metastases.

Within the lymphatic collar, because of the rich supply of lymph nodes and their connecting channels, metastases are rapidly disseminated, although cancer of each part of the head seems to follow a law of its own so far as its primary extension is concerned. Thus, cancers of the skin, of the mucous membrane of the cheeks, and of the mucous membrane of the edge of the jaw usually do not metastasize; cancers of the lip almost uniformly metastasize to the lymphatic glands under the jaw; cancers of the floor of the mouth usually metastasize in the glands of the same side. Paired organs or distinctly one-sided foci usually metastasize regularly, while unpaired organs, as the tongue or mesial tissue, such as the middle of the lip, metastasize irregularly and widely. For example, a marginal cancer of one side of the tongue may metastasize to the glands of the opposite side, although usually low down toward the clavicle; however, the metastasis may occur at any site, high or low, on the right or the left side.

These facts give us the key to the treatment of cancer of the parts which are especially pertinent to this discussion, i. e., cancer of the jaws, tongue, cheek and lips. The prime requisite is the complete removal of the lymphatic glands which are related to the site of

the cancerous growth. Thus, early cancer of the mucous membrane of the gums or cheeks does not demand excision of the glands, while cancer of the lip, however early, demands the complete excision of all lymph nodes which drain the involved area, and cancer of the tongue or of the lip calls for the complete removal of the glands of the neck on both sides. Cancers of the jaws, which metastasize rarely, and usually on the side of the lesion, demand a less radical operation.

In advanced cases, no matter where the primary lesion, a wide regional block excision is demanded. Complete bilateral excisions can be made with an interval of several weeks without fear of ill results, the easiest technic involving excision of the sternomastoids and of both jugular veins *en masse* with the lymphatics. The disfigurement is not striking, and since the adoption of this method in 1898-1899, we have rarely missed securing a permanent cure in any case which had not progressed beyond the lymphatic planes of the neck.

It is not appropriate at this time to discuss operative technic in these cases, or the precaution which the surgeon must exercise to prevent the resowing of the cancer cells, or the precautions which the surgeon must preserve to prevent untoward results. That even the most extensive resection of the glands of the neck may result in a complete cure is evidenced in the end-results of cases of my own. Among 224 cases of carcinoma of the lip, mouth, tongue and jaws performed by my associates and myself, there were but six operative deaths, and those were in cases in which the cancer was so far advanced that the operation was but a desperate hope. I have in mind three cases in particular, in each of which a most extensive block dissection of the glands of the neck was performed. These patients are still living and well—one nine years, one fourteen and one sixteen years after operation.

As for the care of the precancerous lesions, it should be noted that perhaps in no field do radium and the roentgen rays play a more important rôle. The proper application of radium to an obstinate ulcerated surface on the lip, cheeks, or gums is, I believe, the most efficient prophylactic measure at our command. Once a cancer is developed, however, surgery is required, but when to the surgical procedure a single treatment of deep, accurately measured roentgen-ray or radium dosage is added, the best results will be secured.

The cancer problem is not a hopeless problem no matter how long the discovery of the direct cause of cancer may be delayed. The wide dissemination among the laity and the firm adherence of the dental and medical professions to the principle that every cancer is curable in its first stage and that practically every cancer develops from a well defined precancerous condition will go far toward the solution of the cancer problem. As for the prevention and cure of cancer of the cheek, tongue, mouth and jaws in particular, the dentist has a vitally important rôle to play. The extension in our schools of instruction in oral prophylaxis, the insistence by the dentist on the correction of dental defects, his cooperation with the roentgenologist and radium specialist and the surgeon for the cure of long standing irritations and ulcers and the inculcation in the public of a willingness to submit to complete surgical excision once the cancer stage has been reached will diminish to the lowest possible figure the incidence of buccal cancers.

THE EFFECTS OF NUTRITIONAL DISTURBANCES UPON CALCIFICATION AND DECALCIFICATION OF TEETH IN EXPERIMENTAL ANIMALS. A PROGRESS REPORT*

By JOHN ALBERT MARSHALL, D.D.S., Ph.D., San Francisco, California

(Read before the American Dental Association, Cleveland, Ohio, September 10-14, 1923)

AT THE last meeting of the American Dental Association in Los Angeles, I read a preliminary report on a group of nutrition experiments conducted under the supervision of W. P. Lucas, head of the Department of Pediatrics, University of California, and Dr. Martha Jones, of the George Williams Hooper Foundation for Medical Research. At necropsy, the heads of the animals were given to me for examination and identification of dental lesions. Although complete pathologic data have been compiled, these are not appended here, but will be reported elsewhere by Dr. Jones. My interest in the heads has been, as I have stated, only in so far as the teeth and supporting structures are concerned.

The data formerly presented dealt mainly with four abnormalities: those relating, first, to the shedding of deciduous teeth of dogs; second, to the formation of the permanent teeth; third, to the position of the permanent teeth, and fourth, to the relation in the arch between the deciduous teeth and permanent ones. By imposing a restricted diet, we were able to produce lesions resembling rickets, some of the outstanding symptoms of which were those referred to above, namely, the effects on the position and the eruption of the teeth. For example, the deciduous cuspids and molars were, in some instances, retained for a much longer period of time than was the case in the control animals, and the resorption of their roots was very much delayed. On examination of the permanent set, it was observed that some of them exhibited a marked hypoplasia. One lower cuspid, in particular, showed striking symptoms of arrested growth. During the earlier stages of calcification of this tooth, the tip of the crown was apparently normal in development. About one-third of the distance from the tip toward the gingival line, there was a definite constriction produced by cessation of function of the ameloblasts, so that the crown presented a definite narrowing toward the line of hypoplasia. Other teeth exhibited a similar stunted growth. In addition to these evidences of *improper nutrition,* there was a well defined irregularity in the position of the teeth, particularly the lower incisors. In one case, the teeth were clumped together in a bunch, one or two standing directly lingual to the others in the arch. Finally, some of the deciduous teeth were so firmly attached that even the eruption of their successors did not force the first teeth from their sockets.

The diet, which was responsible for these changes, was not described at that time, nor will it be now. However, I am permitted to state that all the food elements were present in what we believe

*Aided by grants from the American Dental Association and from the Board of Research, University of California.

to be sufficient amounts. The only alteration was concerned with the proportions of calcium and phosphorus. These two elements exist as calcium phosphate in both bones and teeth, and the quantities fed the animals were apparently so at variance with the needs of nature that faulty metabolism resulted. In one set of experiments, the phosphorus was given in excess, and in another, too much lime was administered. Between these two extremes there is an optimum quantity of each element, a quantity which will supply fully all physiologic requirements. Such a quantity will not be detrimental to the organism as a whole. These elements were, so far as we know, the only variable factors in the whole dietary regimen. Utilizable proteids, as well as vitamins, were given in the form of meat and other fresh foods. The inorganic elements were supplied in the form of the McCollum salt mixture, except the phosphorus and calcium, which were given in varying quantities as mentioned above.

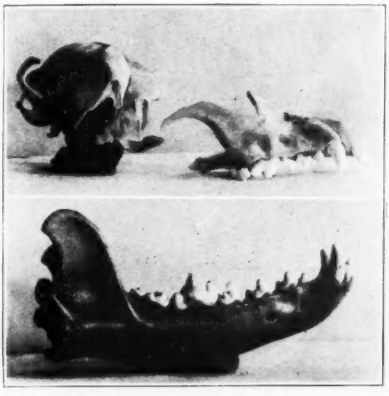

Fig. 1.—Upper and lower jaws of normal animal, which are partially disarticulated to show the osseous development.

Fig. 2.—Hypoplasia of permanent lower cuspid; malposition of permanent lower incisors.

Fig. 3.—Opposite view of same side of jaw as shown in Figure 2.

It is hardly necessary for me to call attention to the fact, now well recognized, that diet exerts a profound influence on the growth and function of bones and teeth. Although there are many

uncorrelated observations reported which need confirmation, the experiments of Shipley[1], Howe[2], McCollum[3], Grieves[4],

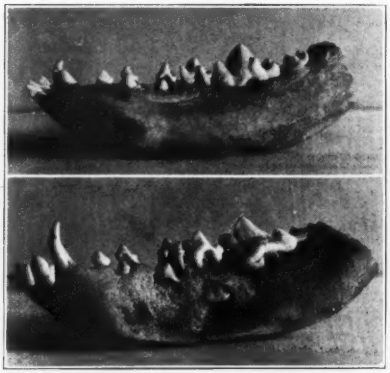

Fig. 4.—Abnormal dentition and bone, the result of diet. Note particularly the retention of deciduous teeth and the porosity of cortical bone.

Sherman[5] and many others all point to this developmental phenomenon.

This paper is essentially a progress report in which certain histologic characteristics are presented. The previous experiments are being repeated and extended, and further data on this problem are being compiled which will be reported at a later date.

Although the macroscopic abnormalities which have been enumerated are distinct evidence of irregularities in calcification, it was not realized what profound changes had occurred in the structure of the teeth until a microscopic examination of the sections had been made. In one of the animals, the dentin underneath a thin enamel cap had become completely decalcified, and had lost all the characteristic structural elements of the

Fig. 6.—Note the hollow enamel caps of first and second maxillary molars, in which normal dentin is entirely absent.

Fig. 5.—Abnormal dentition and bone, showing the effects produced by dietary influences in an upper jaw.

Fig. 7.—Maxillary cuspid showing enamel cap (right) and a fibrous vascular mass which was found in place of normal dentin.

tissue. The separation between the enamel cap and the underlying dentin was easily affected at necropsy, merely by exerting a slight pulling pressure with the fingers on the enamel. This resulted in the complete removal of the enamel in one piece.

By this operation, the soft, decalcified dentin was exposed. There was no normal dentin in the tooth, although the enamel was intact. The soft tissue underneath the enamel was prepared for

Fig. 8.—Looking down into the enamel cap from the gingival toward the tip of the crown.

sectioning in the usual manner, namely, by immersing in a 10 per cent solution of formaldehyde, then carrying it through various strengths of alcohol up to absolute, and finally in xylol. No decalcifying fluid was used at any time. From xylol it was transferred to melted paraffin, and, when cold, cut into sections for staining and study.

On examination, it was found that both the inorganic and organic portions of the dentin had been altered to such an extent as to render their identification impossible. Neither dentin tubules nor tubular contents remained. Even the organic matrix, which is very characteristic in the decalcified section, had undergone profound changes. In its place there was loose areolar connective tissue, richly supplied with fine capillaries

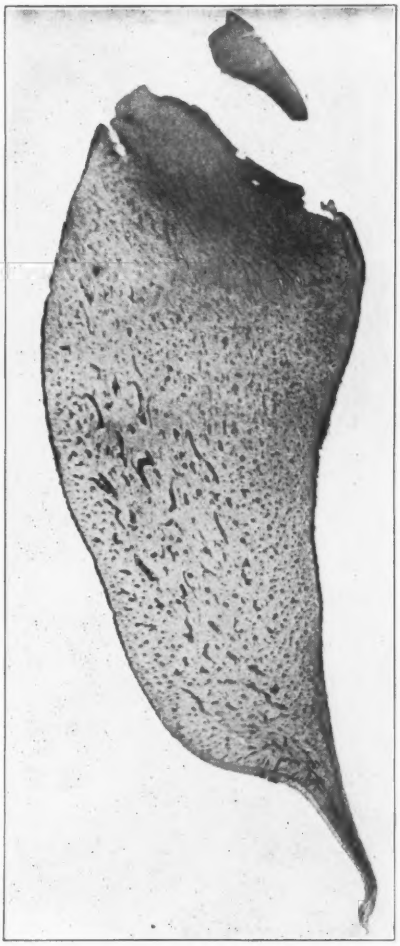

Fig. 9.—Photomicrograph of fibrous mass showing, even at a comparatively low magnification, the inflammatory reactions occurring just before necropsy.

which freely anastomosed throughout the structure. At various places in the section there were inflammatory tissue ele-

ments which indicated that active processes of tissue changes were occurring just before necropsy. These facts throw

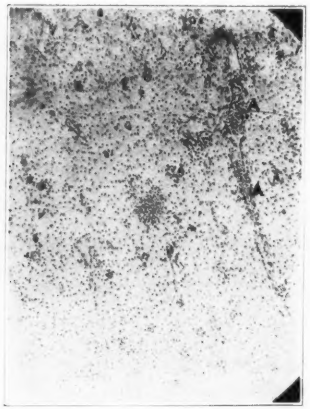

Fig. 10.—High power photomicrograph of tissue. Note enlarged and engorged capillaries at *A*. Throughout the area are evidences of round cell infiltration and of other inflammatory reactions.

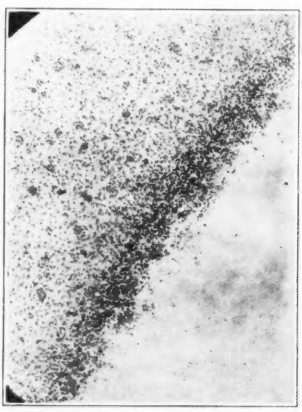

Fig. 11.—Same as Figure 10.

doubt on our classification of this tissue. Is it dentin or pulp? From its intimate relation to enamel, it is obviously dentin, but, from its histologic structure, it resembles an inflamed pulp.

The illustrations presented, as well as the specimen which I have demonstrated, indicate better than a description

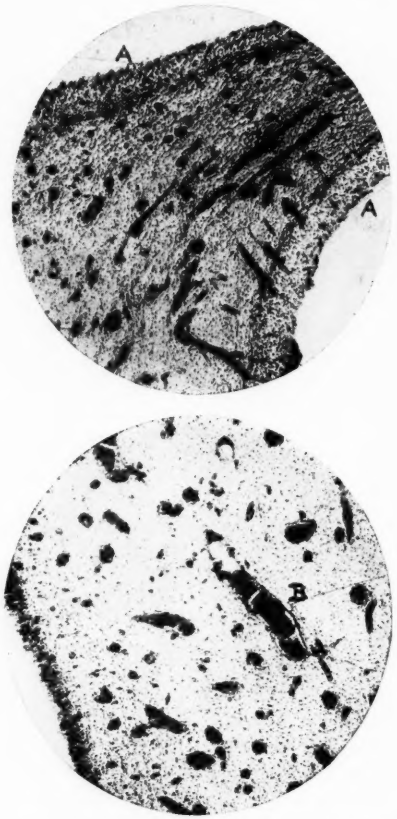

Fig. 12.—Mallory connective tissue stain of tip of specimen, showing odontoclastic layer on both sides, at *A*; enlarged capillary at *B*.

the extent of these lesions. It is disconcerting to examine a skull with teeth intact, and to discover that under an apparently normal enamel, the dentin, which we expect to find normal as well, has either undergone processes of extensive decalcification, or else has not

been formed at all. I am led to the former conclusion, however, especially when the developmental stages of tooth growth are recalled. This development of enamel from the enamel organ, and dentin from the odontoblastic layer, is a simultaneous occurrence in so far as calcification of each tissue is concerned. A normal enamel has never been observed to have been formed without an underlying normal dentin. If there had been no dentin formed at any time in these teeth, it is inconceivable that the size and shape of the enamel cap would be normal, or that it would be without some evidence of lack of a supporting calcified structure. I am referring at this moment not to the cases of hypoplasia, but what I believe to be the more advanced condition, namely, that in which a normal enamel cap overlies a *decalcified* tissue, rather than an uncalcified one.

There remains, then, this other hypothesis which may serve to explain this process of internal decalcification of dentin. The administration of a diet deficient or improperly balanced in so far as calcium and phosphorus is concerned, resulted in a retardation of the deposition of these elements. Owing to the requirements of the growing animal for increasing amounts of calcium and phosphorus, the organism endeavored to meet this demand by robbing its own tissues of previously calcified material. The bones were first affected and were perhaps robbed of as much lime as possible. This source of supply was quickly exhausted, however, and the other tissue in the body capable of supplying the deficiency more readily was the formed dentin. The odontoblasts became odontoclasts and slowly removed the inorganic salts from the walls of the pulp chamber and canal. As this occurred, the cavity became wider and wider, until finally the whole area of dentin was invaded. There are in support of this hypothesis only these two facts: first, animals at necropsy exhibit normal enamel, but decalcified dentin; second, this decalcified dentin is without the normal structural elements, but contains, instead, abundant evidence of a definite inflammatory reaction. Throughout the tissue there is round cell infiltration, proliferation and engorgement of blood capillaries. This inflammation gives evidence of profound changes occurring in the involved tissue, such as might accompany processes of decalcification.

I advance this explanation of these facts as one which more nearly correlates the various observations of the experiment. It will be extremely interesting to follow this research farther, and to note the effects of such deficient dietaries on pregnant animals, and on the young. Such a program, however, demands more funds than are at my disposal, but it is hoped that additional support will be made immediately available. The direct application of this research to the health of children from birth to maturity is at once apparent, for, in the task of seeking to determine those environmental and nutritional factors which are prejudicial to animals, a wider concept of the problems in infant mortality, child welfare, public health, and social service will be attained.

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THE UTILITY OF RADIOGRAPHY IN OPERATIVE DENTISTRY WITH SPECIAL APPLICATION TO PREVENTIVE SERVICE

By CLARENCE O. SIMPSON, M.D., D.D.S., St. Louis, Missouri

(Read before the American Dental Association, Cleveland, Ohio, September 10-14, 1923)

CONVENING under the cryptic slogan of "Prevent, Conserve, Progress," which appears to be in the reverse order of an anti-climax but intended to plead the prevention of disease, it is most appropriate to consider the relation of radiography to preventive dentistry. The popular conception prevails even in the dental profession that the principal use of radiodontia is in the detection of septic teeth, but popular conceptions are rarely based on knowledge or facts. Restricting radiodontia examinations to the search for septic foci or other grave disorders bears the same relation to dental service as necropsies do to clinical medicine; both lead to a postmortem diagnosis by which the patient loses—in the latter, his life, and in the former, his teeth. Radiodontia has innumerable neglected applications which are more cheerful to contemplate and gratifying to apply.

Those who quote platitudes suggest dentistry's taking the next great step in preventive medicine, or dentistry's assuming its responsibility in public health, but if the dental profession does not respond more effectually in prevention than it has in reparative operations, the aching void and the avoidable ache will continue to be the heritage of mankind. An impartial inspection of the evidence accrued in a radiodontic practice compels the conclusion that when the restoration of tooth form or operations incident to pulp involvement have been attempted, the net result is more destructive than beneficial. This record is indefensable in view of the highly developed technical standards which have been established for guidance in these operations, and constructive criticism is more appropriate and expedient than boasting of dentistry's achievements. Rather than theoretical progress, dentistry needs readjustment to apply the existing standards.

The thinker asks whether the effort required to record the principles of radiodontic technic is warranted by the exceedingly small proportion of operators who will adopt them, and cites in argument the disgraceful lack of application by the profession as a whole of Black's system of cavity preparation. The answer is that there should be recorded principles to guide those who desire them, and there may come an Utopian period when, along with compulsory eugenics, dental practice will be required to approximate the established standards.

Radiodontic Standards

Before the general character of oral radiography approaches adequate service, the objective must be advanced from mere "pictures" to radiographic examinations. A "good picture" does not constitute an examination of a region, neither does a profusion of technically imperfect negatives. The requirements of a radiodontic examination may be enumerated

as disclosing for diagnostic purposes the following structures: (1) an extensive periapical area to observe histologic changes, and reveal foreign or anomalous bodies; (2) the roots of the teeth with approximate accuracy, to determine the number, size, form and location; (3) the lamina dura entirely around the roots, which is a significant diagnostic index often indistinguishable because of technical deficiencies; (4) the crest of the alveolar process to reveal marginal destruction earlier and more accurately than by clinical inspection; (5) the pulp chambers and canals to determine the relation of the pulp to cavities and restorations, the access and course of canals for operations, and the relative efficiency of canal operations; and (6) the proximal surfaces of the teeth to detect caries and deposits, and to observe the contact of the teeth and the contour of restorations.

The skill and knowledge employed in the radiodontic examination quite directly control the information supplied by it. Moderate laxity in the technical standard may nullify the benefit by failing to disclose existing conditions or by causing an incorrect diagnosis by a misleading portrayal of conditions. Radiodontic technic cannot be ignored, or the examinations assigned to an unqualified assistant without seriously impairing the service. A competent examination presumes a thorough knowledge of the parts, the ability to differentiate in manifestations, and an appreciation of the evidence presented. Radiodontic technic is equally as difficult as that of the most exacting dental operation, and proficiency can be attained only by intelligent and arduous application.

Vigilance and Early Diagnosis

In physical abnormality and disease, early diagnosis is no less important than correct diagnosis. Chronicity with structural alteration is always a decisive factor in the prognosis. The early recognition and prompt correction of predisposing conditions or incipient lesions is the practical method of coping with dental caries and the destruction of the dental investing tissues. Mechanical prophylaxis has not exterminated oral disease, and the effectiveness of dietetic control is problematical; so operative dentistry remains a strategic field in the defense of masticatory function and oral health. Since the progress of dental caries and periodontoclasia produces a chain of complications, and the amount of destruction limits the success of reparative operations, vigilance is the key to conservation.

Routine Radiodontic Examinations

The value of periodic clinical examinations as a prophylactic measure is generally appreciated, yet this is only a partial investigation of conditions and may lead to a false conclusion of security. Only when the clinical examination is supplemented by a radiographic examination is the inspection thorough, and few dentists discharge their obligation in this regard. Radiodontia offers its most valuable service in these periodic examinations which forestall its more spectacular uses.

To obtain full advantage from radiographic or clinical examinations there must be a routine procedure at regular intervals, not neglected until suggested by pain or limited to suspected regions. A general radiodontic survey rarely fails to reveal something to justify the operation, and must not be depreciated when it does not disclose startling information, for it is no less useful in excluding possibilities. When disturbances arise, radiographic records over a long period are a great aid in determining the pathologic status and therapeutic indications. Appraised as a conserver of function and health, routine radiodontic examinations are an economic service far exceeding the expenditure involved.

Indications in Secondary Dentition

Radiography may serve useful purposes prior to the age of six years, but after this time periodic examinations are imperative to the best interests of the individual. The premature removal of deciduous teeth results in the loss of space for their successors, and the prolonged retention of the primary dentition deflects the succedaneous teeth from their normal positions and retards their eruption. These errors of commission and omission are important etiologic factors in malocclusion and maxillary deformity. The tables stating the average periods of dental development and eruption present considerable latitude and diversity, and the actual process materially varies from the estimated time. Digital or instrumental examination is not dependable in determining the degree of decalcification in the primary teeth which are often firmly retained after little of the roots remains.

The treatment of carious deciduous teeth may be decided by the state of development which their successors have reached. If the radiographic evidence shows the replacing tooth is about to erupt, reparative measures will be obviated; while if less favorable conditions exist, extreme conservative procedure or an appliance to maintain space is indicated. Preventive service of this character is more physiologic in effect and economic than orthodontic treatment occasioned by the negligence or error of the attending dentist.

Incipient Caries and Periodontal Lesions

Next in desirability to the prevention of caries is the early detection of enamel decalcification to intercept the invasion of the dentin and pulp. The susceptibility of the proximal surfaces of teeth to caries is exceeded only by that in developmental defects. Structural imperfections occur on surfaces exposed to vision and instrumentation, while the proximal surfaces are inaccessible to the usual methods of inspection. As a result, before being discovered, caries commonly progresses in the proximal surfaces until the pulp is endangered or involved. Decalcification in proximal surfaces can be distinguished radiographically before the enamel rods are displaced or a cavity exists for the entrance of an explorer.

The recurrence of decay at the gingival margin of otherwise efficient restorations is difficult to discover before serious damage has occurred. Destruction in this location usually necessitates the removal of the cervical enamel, extending the restoration rootwise into the cementum, with increasing proximity to the pulp and probable injury to the periodontal membrane.

Local conditions are a paramount factor in periodontal lesions and periclasia, but the exciting causes seldom prevail around all the teeth. A general radiodontic survey of an adult rarely fails to reveal one or more localized areas of marginal absorption, and the cause of it. Common causes of localized marginal absorption are projecting margins of restorations, calcareous deposits, loss of proximal contact, incorrect contour of restorations, malocclusion, and excessive stress, all of which are remediable.

Excepting acute inflammatory disturbances, the incipient destruction of the alveolar crest can be distinguished by radiography before it is observed clinically, and the early recognition of this change offers the most favorable prospect of arresting the progress. With thorough roentgen-ray examinations and careful study of the negatives, an incalculable preventive service can be rendered in locating these incipient lesions and correcting the conditions which are producing them.

Radiographic Assistance in Restorative Procedures

Pulp irritation or death resulting from the proximity of a restoration is a distressing but avoidable sequel to a repar-

ative operation. A radiographic examination preliminary to cavity preparation is advantageous in outlining and locating the pulp chamber and the recessional pulpal horns, to avoid accidental exposure or dangerous approach. The extensive restorations on vital teeth used as bridge abutments require pits, shoulders, and excessive removal of dentin to parallel axial walls, and these preparations should not be attempted without determining pulp relations. Regardless of the advances in pattern and casting technic, there may be a discrepancy in the adaptation of cast restorations. When this occurs at the gingival margin, which is the most probable location, it is difficult to detect with an explorer, but a radiographic examination with the casting in place before cementation will disclose the fault.

The preparation of the mesial and distal surfaces of roots under the gingiva for shell crowns is usually imperfect because of difficult access, and radiographic examinations will aid in the removal of enamel and adaptation of the band. The ill-fitting band is dentistry's golden badge of shame, and radiography exposes all of its odium but the odor.

Doubtless amalgam will always be employed in the repair of teeth, and the cost of production is not the only advantage in its use. Incompetent or slothful operators will cause less harm with amalgam than with either inlays or crowns. Although the technical requirements of a perfect amalgam restoration are no less rigid than for other materials, the results of delinquency, excepting in proximal contour, are not so pernicious. The proper application of matrices for amalgam manipulation should preclude the possibility of excess material projecting into the interproximal space, but radiographic evidence proves the prevalence of this vicious error and indicates postoperative examinations as a safeguard.

Radiographic Service in Pulpless Teeth

Although radiography has been featured in connection with pulpless teeth, adequate service is still neglected. A preliminary survey should be made before beginning any canal operation, instead of waiting for perplexities to demand it. The preliminary examination is to determine the number, size and form of canals, and the direction of access to the canals, and this may reveal conditions which contraindicate the operation. The lack of this information is responsible for many failures in canal surgery because of the variance in the number and form of canals, and obstructions to access which may be removed or avoided; while incomplete root formation or perforated or necrotic roots may condemn the tooth.

After an attempt has been made to open the canals and remove the contents, exploratory wires should be inserted for the second radiographic examination. If necessary, this procedure should be repeated until the canals are as thoroughly prepared for filling as possible. After an attempt has been made to fill the canals, another examination is indicated. At this stage of the operation there seems to be a temptation to relax discipline, either through an optimistic conclusion that the filling is perfect, or a discouraged attitude of not wanting to know the result. Such conclusions are conducive to inferior operations and impairment of operative efficiency in evading the responsibility of qualifying in the final test. Only by repeated attempts to fill canals thoroughly and the incentive of inflexible ideals is the requisite proficiency in the operation attained.

Within six months after the operation is completed, and thereafter at yearly periods, radiographic examinations should be made to observe developments. In a large proportion of the unsuccessful operations for pulp removal, the evidence of periapical disturbance

appears within a year, and postoperative observation is a duty of the operator, which should be explained in advance to the patient. If service of this nature is rendered in pulpless teeth, there will be few chronic periapical infections to eradicate.

Refinement in Interpretation

Common errors in interpretation range from failing to see obvious manifestations to creating fantastic illusions without foundation. Inexperience, limited knowledge, preconceived ideas and prejudice explain many false conclusions. The layman may be unable to distinguish the teeth, the physician may be unable to distinguish normal radiolucence, and the dentist may be unable to distinguish the failure of his operations; hence the need for the competent radiodontist.

Refinement in interpretation is acquired by intensive and extensive study of radiographic records. Inadequate examinations, inferior negatives, and insufficient study of the radiographic records account for most mistakes in interpretation by dentists and the expressions discrediting the dependability of radiographic evidence. Radiographic evidence is dependable in proportion to the skill employed in collecting it and the special knowledge of the judge who appraises it.

The ability to distinguish slight changes and deduce their significance, instead of observing only advanced processes, is the means of deriving the maximum benefit from radiography. This perception is cultivated by viewing intently with the aid of favorable illumination and magnification, comparing regions in the same and different patients, and considering the available clinical history.

In view of the consistent progress which has been made, the present limitations of oral radiography indicate that the ultimate development is far from being reached. Earnes work along systematic lines will advance this branch of practice far more rapidly than contented indifference or vacillating efforts, and operative dentistry should contribute by a more general use and appreciation of radiography.

Discussion

C. Edmund Kells, New Orleans, Louisiana: 1. Under "radiodontic standards," we find "The *lamina dura entirely around the root* (italics mine), which is a significant diagnostic index often indistinguishable because of technical deficiencies." I am confident that there was a little slip-up here, because I am sure that Dr. Simpson did not intend to say that the "lamina dura" could be shown "entirely around the root," and if he did not mean to say it, to have said it is rather confusing.

As a matter of fact, it is most unfortunate that the lamina dura never can be "shown entirely around the root," and that from no film can *anyone* actually obtain any information whatsoever as to the condition of this lamina dura, whether it is present or absent, upon the frontal and distal (as compared to the source of the ray) portions of the roots. Its presence upon or absence from that small portion of the root that is silhouetted on the film is all that can be shown.

This fact is most unfortunate because an abscess sac (and its attendant destruction of the lamina dura) can be so situated upon a root that the shadow cast on the film, by the very same root, *could show the lamina dura* apparently intact, and so the film would be, not only most misleading, but, in fact, absolutely worthless.

2. While, technically speaking, a skiagraph is not a silhouette, for all practical purposes, it is nothing more nor less than a *shadow picture,* and as such, *it is absolutely impossible* to determine by it the relative positions of any of the component parts in the region which cast those shadows.

It is impossible to determine by a skiagraph the "relation of the pulp to cavities and restorations."

3. We find the following in this essay, "As a result, caries (upon approximal surfaces) commonly progress until the pulp is endangered or involved before being discovered." I do not understand how such a statement can be made. I, myself, must have inserted thousands of *small* fillings upon the approximal surfaces of teeth, when the pulp was not "within a mile," to use a common expression, of being "endangered;" besides which I have seen countless thousands of the

same kind of small fillings—the work of hundreds of other dentists.

I would ask Dr. Simpson to kindly think this over, and see if it is not the *exception,* and not the rule, for a proximal cavity to involve the pulp before being discovered.

4. Radiodontists should appreciate that while it may be true that decalcification in proximal surfaces "can be distinguished radiographically before the enamel rods are displaced or a cavity exists for the entrance of an explorer," careful and thorough dentists do not wait for the "displacement of enamel rods" or for a "cavity to exist for the entrance of an explorer" before giving their proximal surfaces the necessary attention.

Decay upon the proximal surface begins as it does upon all other surfaces, and that is upon the *surface itself.* When this decay reaches the thickness of a mosquito's eyelid, or even before that, the careful and thorough dentist notes the discoloration, for there are no other means of discovering it at that time, and polishes it off, thus restoring the surface to its original luster, and this is, by comparison, ages before the roentgen ray could discover it.

1. In order to discover this decay, would it not be necessary to flash the ray exactly along with, and parallel to, the proximal wall of the tooth to be rayed? 2. How many films would it be necessary to use in order to examine the thirty approximal spaces, both above and below? 3. How often should the teeth be examined in this manner in order to catch this decay before the "enamel rods are displaced sufficiently for the entrance of an explorer?"

I believe that the radiodontist is in error when he says, "The recurrence of decay at the gingival margin of otherwise efficient restorations is difficult to discover *before* (italics mine) serious loss has occurred." Any careful operator can readily discover this decay on the usual careful examination of the tooth, and in many cases this "recurrence of decay" cannot possibly be shown on a film at all.

I make the assertion boldly that it is an indisputable fact that every fault upon the crown of any erupted tooth is within easy access of an explorer in the hands of a careful operator, and that no film or series of films is ever necessary to disclose any faults upon these crowns. It may be necessary (and it frequently is) to separate two teeth in order to examine the proximal surfaces satisfactorily.

Howard R. Raper, Albuquerque, New Mexico: I agree with Dr. Simpson in everything except a few details which are of no consequence. That is to say, I agree that the future of dentistry, and so the future of the application of radiodontia to dentistry, resides in prevention.

And here is a gentle word of warning. Be careful about claiming to be able to find all proximal cavities without the assistance of the roentgen rays.

Dr. Simpson says that radiographs will show a small decalcified spot in the enamel before an actual cavity, or hole, in the tooth exists. This, I believe, is true, and I believe Dr. Simpson was the first to make this observation. But one must not get the idea from this that all the very small spots one sees in radiographs in proximal surfaces are simply decalcified areas and not actual cavities. Some extremely small spots may be actual cavities. When examining small proximal cavities radiographically, one must notice closely the dentin just under the perforated enamel to see if it has commenced to undergo disintegration.

THE CAST GOLD ABUTMENT IN COMBINATION WITH THE PORCELAIN JACKET CROWN

By JOHN E. ARGUE, D.D.S., Seattle, Washington

(Read before the American Dental Association, Cleveland, Ohio, September 10-14, 1923)

THE method of supporting fixed bridges by the use of cast gold three-quarter crown abutments was a remarkable advance, and we owe great respect to the men who so admirably devised and gave this method to dentistry with such a highly developed technic that it can be universally adopted by the profession, making it possible, to conserve the vitality of the dental pulp in teeth which are to be used as abutments. Moreover, a closer adaptation to the abutment teeth is possible followed by a healthy condition of the gingival tissues, and consequent freedom from influences which in the old form of bridgework often had a serious systemic effect; and last, but not least, an esthetic effect is possible of accomplishment, particularly on the anterior teeth, which never was before attained in fixed bridge operations.

In cases in which fixed bridges are recommendable, we sometimes find that, where caries has been very prevalent, attacking the surfaces of some of the anterior teeth to such an extent that filling operations with extensive outlines were necessary mesially, distally, and possibly including one or the two incisal angles, discoloration also has taken place to some degree; the pulps, of course, have become receded, and, in most cases, remain alive and healthy.

If such teeth are selected and must be used as abutments, the outline for the three-quarter cast crown preparation must be made broad enough mesially and distally to eliminate the outlines of the previously made operations, necessarily displaying a great amount of the cast metal; this, together with the discoloration that may have taken place, gives in all a very displeasing result from an esthetic standpoint.

Anterior teeth containing vital pulps that are slightly out of line in the arch labially or lingually can be used as abutment teeth, and the esthetic effect can be materially improved if the alinement is changed to harmonize with the teeth to be replaced in the arch. This can be accomplished by use of the porcelain jacket crown, properly applied.

In just such cases I wish to present to you a method of combining the esthetic possibilities of the porcelain jacket crown with the cast three-quarter crown principle, combining the esthetic with a fine practical result as an abutment in fixed bridge cases.

The method embodies a cast gold base, made on the three-quarter crown principle, and on the mesial or distal, as the case may indicate; for the attachment of the pontic, a spur is formed to extend occlusally to the normal contact point, giving the proper approximation of the pontic to the abutment tooth, and also the proper interproximal space gingivally for the gingiva.

The form is carved first in wax, which is made to represent in a general way the preparation of a porcelain jacket

crown on the mesial, distal and lingual surfaces.

On the labial or buccal surfaces, the enamel is removed and a shoulder cut

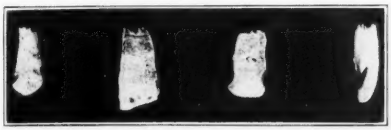

Fig. 1.—Condition in which caries has attacked the mesial, distal and labial surfaces, requiring large filling operations.

under the free edge of the gingivae, which becomes continuous mesially and distally with the shoulder on the cast abutment.

At the side where the spur extends

Fig. 2.—Condition in which caries has been very prevalent and large filling operations were necessary.

for the attachment for the pontic, the shoulder is carried over this spur to the lingual in the form of a rounded groove, linguolabially or bucally, extending

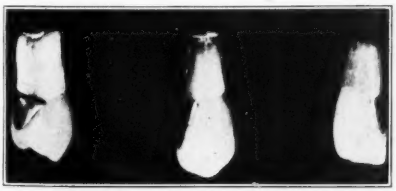

Fig. 3.—The combination porcelain jacket crown and cast gold abutment on an incisor, cuspid and first bicuspid, showing the porcelain jacket crown completely concealing the gold on the labial or buccal, also showing the gold exposed at the proximal surface where the pontic can be attached.

gingivally, to give necessary thickness to the porcelain at that point, yet leaving a thickness of gold to give ample strength at the base of the spur gingivally, to support the stress on the bridge.

The esthetic being considered principally for the use of this type of an

Fig. 4.—Cast three-quarter abutment showing its form for the reception of the porcelain jacket crown.

abutment, its practical use would be limited to the incisors, cuspid, and, to a limited extent, the bicuspid teeth.

Preparation

The preparation is begun by the use of a 7/8 inch safe side carbo disk, run at a medium speed, with a stream of water thrown on the stone to keep down the friction heat, making a clean cut from the incisal or occlusal to the gingiva on

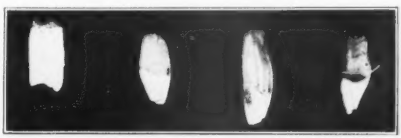

Fig. 5.—Teeth prepared for such a three-quarter abutment casting, showing the extensive cutting necessary to provide thickness of gold, also porcelain for strength.

the mesial, also on the distal; the thickness of the cut can be determined only by the size of the tooth operated on and the position of the approximating teeth. The occlusion now is carefully examined before grinding off the lingual or the occlusal enamel to determine how much

grinding will be necessary to allow for the thickness of the gold coping and, also, the thickness of porcelain that is to cover the gold and endure the occlusal stress involved.

A No. 243 Miller is used to grind these surfaces. The No. 78 Miller pointed stone is used to grind off the remaining part of the singulum in the anterior teeth, and also for removing the linguogingival ridge of enamel below the free edge of the gingiva, which should be done very carefully so as not to cause injury to the gingiva, the surface being

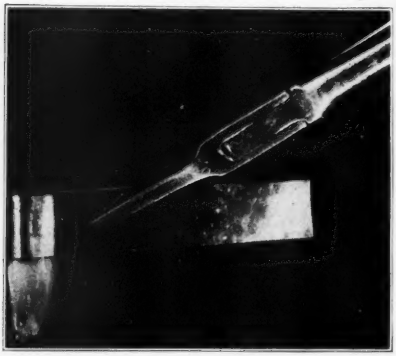

Fig. 6.—Taking measurement for copper band.

tapered down to a bevel so that a feather-edge casting can be formed to fit down to the tooth snugly under the free edge of the gingivae. This bevel can be carried around on the approximo-gingival margin mesially and distally by a ⅞ garnet, fine grit paper disk, a stream of cold air being directed down under the gingiva while working, thus giving a clear field and keeping down the friction of the disk, and the bevel being extended around the angles on the surface labially or bucally at the gingival margin.

The incisal edge now is ground off also, in accordance with the occlusion. A No. 5 gem point is used to grind a groove in the dentin on the incisal or on the bucco-occlusal; this groove is continued on the mesial and distal, it being carried gingivally to a point just where

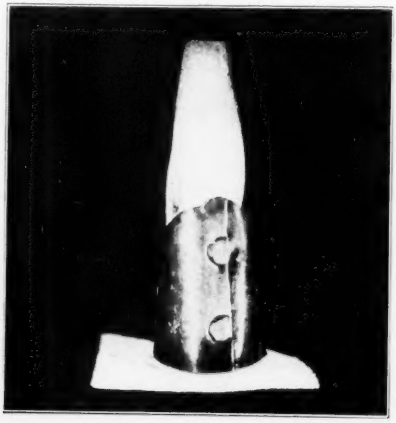

Fig. 7.—Taking wax impression in copper band.

the bevel begins. It should end at right angles to its long axis, an operation that can be done with the square end of the

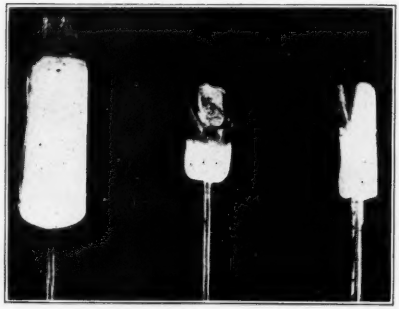

Fig. 8.—On the left, wax impression run up with casting investment; center and right, copper band removed and wax model formed up for the cast abutment.

fissure bur. This square ending gives more resistance and retentive form to the staple form of the casting, thus

giving a very necessary added strength to the abutment. The featheredge of the casting that extends gingivally from this point can be burnished, so that when the abutment is driven to place, it gives a clean, adapted joint that will cause very little, if any, irritation to the surrounding soft tissues.

The labial or buccal enamel is always left intact until the bridge is finished and set to place.

The preparation on the bicuspids differs from the upper six anterior teeth in that the occlusion is considered in a different way, as providing a thickness

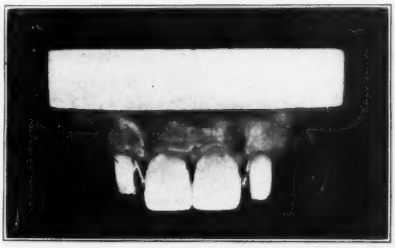

Fig. 9.—Finished bridge set in place, showing cast three-quarter abutments supporting a bridge on the upper lateral incisors, and also the preparation for the reception of the porcelain jacket crown.

on the occlusal ends of the bicuspids to support the occlusal stress and also on the lower six anterior teeth. The occlusal stress is greater normally at the labio-incisal angle, which must be taken into consideration, and a thickness provided to maintain this stress.

Wax Model

The tooth being prepared, the next step in the operation is taking the wax impression and making the wax model.

The preparation is slightly moistened with cocoa butter; a copper band is fitted to the prepared tooth. I prefer using some thin sheet copper, No. 36 gage, cut in strips 5 to 10 mm. wide; with this one can take an accurate measurement of the tooth and attach the ends with a stovepipe joint, making a band that always fits if carefully made. This is festooned to the curvature of the gingiva, the joint in the band coming at the labial or buccal. A little square of paper can be placed over the incisal or occlusal end of the band and held with one finger, the gingival end up. The ring is filled with softened light green impression wax. This color is used as it is more transparent, and, in carving up the model one can accurately determine the thickness the casting will be at any given point. When

Fig. 10.—The two lateral incisor porcelain jacket crowns placed, showing completed bridge. Note the interproximal space, giving room for the gingiva to assume its proper form.

the ring is filled, the wax is puddled with a hot spatula until it is all uniformly softened, then it is placed over the prepared tooth and set well down to place by an even pressure toward the gingivae. It is chilled with some cold water, and the surplus wax is removed at the interproximal with instruments and strips, and the wax chilled again, just before it is removed. Removing the impression must be done with great care. Any lateral or rotating movement would distort the fine lines, so the procedure must be to remove in the direction occlusally with the long axis of the mesial and distal grooves. After removal, the impression is dried out with compressed

air and examined with a magnifying glass to see if it is correct. If it is faulty, the cavity preparation is corrected if necessary, in order that the impression will draw properly, or the impression is retaken until one gets an accurate reproduction of one's preparation.

A strip of paper about 10 mm. wide is now wound around the outside of the copper ring of the impression, the paper extending over the gingival end of the band its greater width. This is waxed to place by some soft yellow wax, care

Fig. 11.—Case in which upper right lateral incisor, vital, is badly broken down with caries and stands out of line labially; bridge cemented to place with abutment casting on this lateral incisor.

being used in doing so in order that the wax may flow on the outside only. The impression must be held lightly in the fingers so as not to distort the wax impression inside the ring. The wax impression is then chilled with cold air, washed out with acetone, and then flushed out with a cold stream of water. Some reliable investment is carefully mixed and the impression is run up, applying first with a camel's hair brush, jolting well to expel all bubbles and filling it till a good surplus extends up over the end of the paper band. A wire of No. 12 gage, 3 inches long, can be used for a handle. The wire end is inserted up into the impression, and the end of the wire should extend only up into the paper band about 5 mm. short of the gingival end of the wax impressions. This is very necessary, so that when the wax model is cut off the handle, the investment under the wax will not be broken. This now is laid on its side on a sheet of paper till it has well hardened, which should be at least five hours; after this time, the paper and copper bands can be slit with the sharp point of a knife and removed.

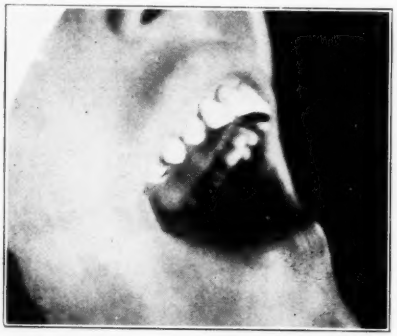

Fig. 12.—Same bridge shown in Fig. 11, with right upper lateral incisor porcelain jacket crown cemented to place, completely concealing the cast abutment.

The forming of the wax model is now begun; the handle enables the operator to hold the model in any position. With a hot spatula, the surplus is removed from the incisal or occlusal, and, more being added to the parts, a model is roughly formed of the pattern one wishes to reproduce. It is then disked down to quite an accurate form, a stream of cold air being used to keep the friction heat from softening and distorting the wax model. The translucent wax aids one in determining the thickness of the wax at different points. A spatula with a square end has been found a very efficient instrument to use to form the shoulder and spur and complete the detail form. After this has

been completed, it is washed. A sprue is inserted at the spur, and, with a saw, the investment is cut just below the wax off the handle, and it is then ready for investing. This abutment should be cast in some hard rigid metal such as T or double T gold.

The most careful investing and casting technic should be followed out in order to get a smooth casting with well reproduced detail lines. This greatly facilitates the abutment in fitting into place on the prepared tooth.

When fitting the casting to the preparation, the gingival part of the casting is disked down to a featheredge of metal that is festooned to go just under the free gingiva at all points. The spur for the attachment is also ground to the approximation of the pontic. Impressions are then made and the bridge is completed, in the usual way, and cemented to place. At a following sitting, the labial or buccal enamel is ground off, a shoulder preparation is made at the labiogingival or buccogingival, carried just under the free edge of the gingiva, which is made continuous with the shoulder on the abutment mesially and distally; the occlusion is noted and ground if necessary, in order to give ample thickness to the porcelain.

A jacket crown is made and completed on this preparation with the usual procedure as a separate operation, and when cemented to place, adds the connecting link which finishes the bridge operation and also completely conceals the gold abutment, giving the highest possible artistic and esthetic result.

I wish especially to emphasize that this type of an abutment has its limitations, and good judgment must be used in selecting the cases where it will be successful. In the first place, it should be confined principally to teeth that have had large extensive filling operations; these teeth generally have greatly receded pulps, so that the necessary cutting can be done without danger to the life of the pulp. The only exceptions to this on unbroken surfaced teeth would be where the occlusion is such that there is a space between the occluding teeth for the thickness necessary of the cast gold and porcelain without cutting too deeply into the tooth operated on.

With upper teeth that are slightly out of line labially (and here you have the ideal conditions to work with), and also when the tooth is operated on for the jacket crown, the alinement in the arch can be corrected to a great extent, materially improving the esthetic effect. In another condition, where the teeth have been worn excessively and the operation of opening the bite is recommendable, where anterior teeth are to be replaced, some of these worn teeth can be used as abutments. They, of course, have greatly receded pulps and the necessary opening made to lengthen the bite affords ample space, so that such a type of abutment can be successfully used and the jacket crown operation made to restore the proper length to the tooth operated on, thus completing a most ideal restoration in opening the bite.

If these suggestions are followed out and a wise selection of cases made, combined with careful operating, pulp conservation can be controlled to a maximum, which is the most important consideration in this operation.

THE ALIMENTARY CANAL—A TALK TO DENTAL PATIENTS

By GILLETTE HAYDEN, D.D.S., Columbus, Ohio

(Read before the American Dental Association, Cleveland, Ohio, September 10-14, 1923)

THE function of the alimentary canal is to receive food, grind it, manipulate it and digest it, to transmit the digested food to the blood stream, and to eliminate the waste solids which are left as a by-product of digestion.

The alimentary canal is a continuous hollow muscle. In this canal are three reservoirs connected by tubes, each of which is equipped to perform, in turn, its special functions. The three reservoirs are the mouth, the stomach and the colon. In each of these reservoirs the food is held for a time, while in the passages connecting these organs, it is in transit. With the exception of the special function of the teeth which grind the food in the mouth, the entire alimentary tract manipulates the food and passes it on from one part to another by its power of muscle expansion and contraction.

Two sentinels guard the gateway to the body. The eyes and the nose aid in deciding what food shall pass the entrance to the alimentary canal. Through their special sense functions they convey to the intelligence their message as to the acceptableness of foods.

Within the mouth three more sentinels act as safeguards against the intake of unacceptable foods. The tongue, with its sense of taste, protects against unknown or unfavorable foods, and the tongue, palate and teeth, with their sense of touch, guard against the swallowing of insufficiently masticated food, or food contaminated with hard, foreign bodies.

Over all these special sentinels stands the intelligence. With such a splendid equipment for protection there is every reason to suppose that the alimentary canal will be safeguarded to the fullest extent, and thus be free to perform its functions without hindrance. Unfortunately, human beings, through their voluntary acts, *do* interfere with the processes of digestion.

The successful operating of the digestive mechanism is dependent on a normal, healthy condition of the parts themselves; on the raw materials given them to manufacture into finished products of nutritional value to the body tissues; on proper mastication of foods; on cleanliness; on a happy state of mind; on healthful exercise and pleasant recreation, and on rest and refreshing sleep.

To provide the necessary raw materials to build, repair and maintain the body tissues, and to aid in the proper functioning of the alimentary canal, the intelligent selection and combination of foods is demanded. These foods must be of good quality, combined in proper proportions and prepared in such a way that they furnish, in sufficient quantities, all the necessary elements for the successful nourishment and healthy operation of the entire body.

There are certain essentials in the selection of foods which seem to need emphasis. One essential is that foods in their preparation for consumption should

lose as little as possible of their natural parts.

The cereals, perhaps, have been molested by refining methods more than any other group of foods. For instance, white, or patent flour has been deprived of most of the mineral elements and all of the roughage of the natural wheat berry. Without the bran coats and the germ of the wheat berry, the natural calcium, phosphorus and vitamin contents of this food are lost, and the roughage which furnishes the bulk so necessary in the waste required for elimination is entirely lacking. These valuable elements are fed to the stock down on the farm. Every farmer knows what happens to his stock when it is not fed on coarse foods which furnish roughage in the diet. The same thing happens to human beings. It seems that the more man interferes with natural foods in an effort to improve, not their perfection, but their preparation for human consumption, the greater trouble he stores up for the human family.

The presence of roughage or indigestible bulk in foods is another essential. Coarse foods are necessary because they help to keep the whole digestive tract clean, and help to prevent clogging of the large intestine, which so often occurs when the necessary bulky waste is lacking. They are an important factor in mastication for they force more vigorous use of the teeth.

Another essential of great importance is the combining of foods in such a way as to provide the food elements to the body in their proper proportions. The belief is that a certain ratio must exist between the various elements in order to secure the best nutritive value from foods. Research work tends to show that the tissues of the body are best grown, developed and maintained, and function best, when the majority of the daily food consists of vegetables, fruits and dairy products, with a less proportionate amount of meats and cereals.

The first of the three reservoirs in the alimentary canal is the mouth. It holds a strategic position as the port of entry for all foods for the body's maintenance. Because of its position as the gateway to the body, and because of its special equipment for preparing food for the rest of the alimentary tract, the mouth has a vital service to render the whole digestive apparatus.

In this first reservoir the food remains while it undergoes the necessary preparation for further digestion. Over the mouth every person exercises a certain amount of direct control. Everyone exerts a voluntary control over the food which goes into the mouth and a voluntary control over the preparation of food for swallowing.

It is the function of the mouth to receive the food and water and to detect their flavors; to grind or masticate the food so fine that the digestive juices will have ready access to every particle; to moisten and mix the food with saliva, which is the first digestive juice to come in contact with the food and convert starches into sugars; and to cover the bolus of food with salivary mucus so that it may be swallowed in a lubricating vehicle. The mouth is also an organ of speech.

If the vitally important function of mastication, over which each person has direct control, is carried out so that each mouthful of food is very finely divided and thoroughly mixed with saliva, the duty of the mouth will have been performed.

Thorough mastication of all food is essential to the health of every person. It must be carried out in order to maintain health; in order that every particle of food which can be utilized as nourishment for the body may be made available; in order that the teeth, their supporting tissues and the muscles of mastication may have proper exercise, and in order that there may be no overloading and poisoning of the system with fermenting and putrifying pieces of undigested food lying in the stomach or colon.

Without thorough mastication of the food the rest of the digestive tract cannot perform its functions normally or successfully. If insufficiently masticated food is persistently sent to the stomach, the usual result is disease of the stomach or the colon or both.

It is evident that a good dental apparatus is an essential to proper mastication. Without sound teeth well placed in the dental arches and supported by healthy foundation tissues, the mouth will be handicapped in performing a most vital function. Irregular teeth, sore teeth, unfilled or improperly filled teeth, vacant spaces resulting from decay or extractions, inadequate substitutes for lost teeth, loose teeth, or sore and bleeding gums, all interfere in some degree with the mastication of food and are a consequent menace to health.

As already pointed out, coarse foods and hard foods which demand mastication are essential to the general well being of the teeth and their foundation structures. Such foods help to keep the teeth polished and clean and their supporting tissues properly exercised.

The mouth should be at least as clean as the food that is put into it. The contamination of food by an unclean or diseased mouth throws an extra and unnecessary burden upon the other parts of the digestive tract. It is of the utmost importance that the mouth be free from disease of the teeth, gums and their associated parts, and as clean as daily personal care and regular dental prophylaxis can keep it. Not only does an unclean or diseased mouth jeopardize directly the health and functions of the rest of the alimentary canal, but indirectly, through the blood stream, it affects the general health. Infections about the teeth frequently cause serious diseases in other parts of the body and in other parts of the digestive apparatus. It has been aptly said by a successful gastroenterologist that, "infection above and bad drainage below causes most of the ills of the stomach."

The second reservoir, the stomach, receives, through the esophagus, the food prepared for it by the mouth. The sight, the smell and the taste of food stimulate the stomach to proper functioning before the food reaches it. In order to function successfully and normally, the stomach must receive properly selected, clean and uncontaminated food that has been so masticated and mixed with saliva that the first process of digestion has already taken place. Proper digestion of food in the normal stomach is also, in part, dependent on freedom of the mind from disturbing influences of any kind, and on the absence of excessive fatigue, either of body or mind. If these conditions are met, the normal stomach will take care of its share of the digestive processes automatically and without incident.

Some of the voluntary acts of human beings which interfere with the natural functioning of the stomach are: (1) improper selection of foods; (2) inadequate mastication and insalivation of food; (3) hurried eating; (4) dilution of digestive juices and chilling of stomach by drinking cold water at meals; (5) unpleasant or disquieting thoughts or discussions during meals or immediately after; (6) eating between meals; (7) eating excessive amounts of foods, and (8) eating while excessively fatigued.

From the stomach the food passes into the small intestines, where digestion of the food is completed, and where the food of nutritional value is largely transmitted to the blood for distribution to the body tissues. The waste products are passed on into the large intestine.

The third reservoir, the colon, receives the waste solids which are to be eliminated, and passes them on to the rectum. If the proper foods have been eaten and the upper portions of the alimentary canal have functioned without interference, then the normal functioning of the colon is to be expected.

Aside from abnormalities, those conditions which may interfere with the

normal functioning of the colon have their origin in the inadequate selection of food and the imperfect preparation of it in the mouth, in infection located in the mouth, head and throat, in psychic states, in overfatigue, in lack of exercise, overeating, in rapid temperature changes, and so forth. The failure to select foods which contain bulk and roughage is a fertile source of disturbance to the correct functioning of the colon. Coarse foods are of the greatest benefit because they furnish a loose and less condensable mass of waste for the colon to deal with. Such a mass responds readily to the muscular action of the colon, thus permitting easy and complete expulsion of these by-products of digestion.

Perhaps it would not be amiss to mention specifically some of the results of inadequate mastication and insalivation of food in the mouth on the remaining parts of the alimentary canal. The stomach is the first to reflect the irritation thus produced. A peristaltic rush frequently results from the irritating effect of the presence of undivided food on the mucous membrane of the stomach. The secretion of the stomach fluids is overstimulated, the muscular contraction of the stomach walls is abnormally increased, and the stomach content is too rapidly emptied. A similar condition is brought on in the intestinal canal, with the added irritation, there, of fermentation of the undivided pieces of food and gas formation, distention of the bowel and spasm of the muscles. Naturally, such a condition results in a diarrhea or colitis.

Constipation is often an aftermath of this condition because the tone of the intestines is so lowered that their secretory functions are diminished, and their power of muscular contraction is reduced to the minimum. The walls of the colon become flabby and distended and the canal itself becomes filled with a mass of waste material which it has no power to expel.

This type of irritation of the stomach, if long continued, may result in a cessation of the flow of gastric juice, due to tissue destruction, in which event any infection in the mouth becomes a greater menace because the inhibiting effects of the stomach fluids on infecting microorganisms is removed.

Should an infected condition of the teeth or their supporting tissues exist, it can be readily seen that opportunities are afforded microorganisms for unimpeded entrance into the lower parts of the alimentary canal. The *streptococcus viridans,* so destructive to human tissue, finds ready shelter out of the main channel in the gallbladder and the appendix.

From this very limited discussion of the alimentary canal, it is most evident that the health of the mouth, as a whole, the possession of a good and useful dental apparatus, and the complete use of it in the mastication of proper foods, are of vital importance to the well-being and successful functioning of the other parts of the alimentary tract, in particular, and of the whole body, in general.

Discussion

Celia Rich, Nashville, Tennessee: To my mind, Dr. Hayden, in talking to her patients, has dealt too briefly with the first part of the alimentary canal—this port of entry which, after all, is most especially the dentist's province. We are proud of our specialty and I think the pride with which we speak of the importance of our field of work as a part of the alimentary canal is a pardonable pride, one which our patients will appreciate if we devote the greater part of our discourse to it. We should be able to talk most interestingly and intelligently, surely most authoritatively of that region with which we are most familiar.

In the wonderful mechanism of dentition, we have one of the greatest examples of Nature's infinite wisdom and of her efforts for self-protection. Nowhere else in the body has she fortified herself more strongly than in the teeth themselves. The enamel is the most refractory substance in the body. The dentin is next. Each individual tooth is shaped to give not only the best service in its particular function but also is provided with curves and convexities and planes and grooves to deflect food from those parts which might be injured by it. The teeth are implanted in the

jaws in a fashion which is unique, the hard tooth root being accurately fitted to a socket in the bone, which socket is carefully padded, as is the tooth root, so as to prevent jarring of the one against the other. The contact surfaces of the teeth of the opposing jaws are so arranged that when they come together, as in chewing, the greatest force of the bite will go to parts of the supporting structures of bone and gum which have been purposely thickened and strengthened to meet this strain.

Now, when patients ask complainingly *"Why* do our teeth decay and our gums become diseased?" I tell them all this and more besides, and perhaps show them, with charts or casts, the wonderful arrangement of inclined surfaces and interlocking cusps and then ask them if they do not think that Mother Nature did her level best in the mouth, and that, when she laid down her tools at this point with a sigh of satisfaction, she was justified in believing that here at least was her handiwork fool-proof.

In discussing diet with our patients, and we must discuss it early and late, it would not be amiss to call attention to the spectacular results obtained in research work in diet on animals at Forsythe, at Johns Hopkins and elsewhere, for even though we may not be able to draw an exact picture of what takes place in the human dentition from these lower animals with their persistent teeth, the difference is, after all, largely one of degree, of magnification of effects, and is for this reason the more impressive.

Again, in referring to the serious metastatic diseases resulting from oral lesions, we are missing a good chance to score, I think, when we do not make use of the recent amazing results obtained in the research work of Meisser at Rochester. Let us tell our patients at least of the one set of his experiments in which healthy dogs have been inoculated through some of their own teeth, purposely deprived of their pulps and infected with organisms taken from pulpless teeth in human beings suffering from renal calculi. Let them know how these dogs inoculated with tooth germs from the mouths of human beings suffering with this malady developed identical lesions, actually demonstrable kidney stones[1]. Such concrete examples of what happens to persons who disregard Nature's signs and warnings seem to me to constitute our most eloquent means of educating the layman.

In concluding such a talk with my patients, I should emphasize always the interaction and cooperation which exists between all parts, not only of the alimentary tract, but of the whole body as well—a cooperation which should be an example and is an inspiration for a stronger and even stronger alliance between the professions of dentistry and medicine.

E. Melville Quinby, Boston, Massachusetts: I shall begin my remarks rather abruptly with a quotation from Osler's Medicine[2]; "Captivated by the theories of Metchinkoff, we have been for some years on the crest of a colonic wave; and intestinal toxemia has been held responsible for many of the worst of ills that flesh is heir to, more particularly arteriosclerosis and old age. Seniles and preseniles of two continents have been taking sour milk and lacto-bacillary compounds to the great benefit of manufacturing chemists! Much of what is regarded as intestinal toxemia is really intestinal infection."

In the light of the preceding statement of Osler's, there is a logical transference of thought toward a passage in Dr. Hayden's paper: "and in order that there may be no overloading and poisoning of the system with fermenting and putrifying pieces of undigested food lying in the stomach or colon." Herein is a basis for profound thought—especially in the realm of etiology. The dental profession is faced with many serious problems; and a multitude of solutions—as divergent as the poles—of the said problems. One question frequently asked is: "Are intestinal infections caused by dental conditions?" or again, "Is not the dental condition caused by intestinal infection?" Or, put it this way, "Do bad teeth cause bad health; or bad health cause bad teeth?"

If local infection in any part of the oral cavity is capable of causing secondary infections in joints, stomach, intestine, gallbladder, appendix, etc., why is it not equally possible for the condition in the colon, as described by Dr. Hayden, to cause secondary disturbances in the mouth? Is it not more reasonable to suppose a condition of a vicious circle? Unhygienic conditions of the oral cavity and imperfect functioning of the masticating machine prevent a satisfactory preparation of the foodstuffs; the stomach and intestines have to work overtime; proper assimilation of nutritious elements is prevented; normal metabolism is perverted; blood supply is affected in quality; anemia, general or local, results. Such a process works backward. An imperfect masticating machine was the start and periodontoclasia the result. With regard to dental periclasia, the vicious circle is only one of the factors in a mixed etiology. While treating in the paper mainly of the reservoirs, Dr. Hayden speaks of the small intestines as a place "where digestion of the food is completed, and where food of nutritional value is largely transmitted to the blood for distribution to the tissues." It seems a pity that time and latitude prevent a more prolonged

survey of the function of the small intestine, and the results of perverted metabolism. There, again, it stands to reason that interference with the distribution of essential factors in nutrition must have a profound influence on all bodily tissues. Percy Howe[3] shows indubitable evidence of various dental lesions, including caries and periodontoclasia in monkeys through defective feeding.

Dr. Hayden (closing): Relative to Dr. Quinby's remarks, it was not my idea in this talk to place too much emphasis on the mouth. I wished to call attention to the entire alimentary canal with its several parts and the interrelated functions of these parts. In endeavoring to have patients realize that the entire alimentary tract is one continuous canal performing a series of functions which together bring about the preparation, digestion and assimilation of food and the elimination of waste, it has been my desire just to give the mouth and its functions their natural place in relation to the rest of the digestive tract.

The picture I wanted most to present was one setting forth the normal functioning of the canal, not one laying emphasis on the destructive things which happen to it. I have a very strong aversion to giving a patient destructive ideas with regard to the normal body processes, and prefer, instead, to give as large an idea as possible of the exceedingly fine and wonderful construction of all those parts and their power to do their work properly if we will only aid them intelligently. That is why I have mentioned so little about disease.

I think I touched on Dr. Quinby's mention of the fact that colonic stasis results in a disease reaction upon the mouth itself. When I have a patient affected with periodontal lesions, this disease phase has to be taken up, but when discussing the alimentary canal with a child and trying to get the child to use his mouth thoroughly, I do not want him to have a disease thought, nor to have the idea that destructive changes can take place: I wish him to have the idea that he can, with the proper use of the organs at his disposal, do a wonderful piece of work for his entire body and its health.

As to the question of drinking water with meals, I knew that would be a point of controversy. There are those who believe it is right and advisable to drink water with the meals, and there are those who do not. I, personally, confess that I belong to the group that does not. I think that if we drink the water needed by the body in between our meals, we will be safeguarded to a very great extent at meals. What I mean by safeguarded is this: When you have a glass of water at your plate, the tendency is to use it to moisten the food, instead of depending on the saliva. I think it is bad psychology to have it there in the first place. I do not like the suggestion of it and do not think it is necessary. If we masticate our food thoroughly, the salivary glands will perform their function perfectly and the addition of water is not necessary or advisable. I can make that statement as the result of convictions that have come to me through my practice of—I will not tell how many years. I have tested it both ways, and after many years of practice, I feel that I have a basis for my opinion on the subject.

My idea in bringing this paper before you was not to tell you what to tell your patients but to throw out the suggestion that there is something you can tell them about the mouth in relation to the rest of the alimentary canal, and if I have succeeded in doing that I shall be very happy.

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THE PROBLEM OF INTRODUCING ORAL HYGIENE INTO THE PUBLIC SCHOOLS AS A COURSE OF STUDY

By R. S. TOWNE, D.D.S., Bismarck, North Dakota

(Read before the American Dental Association, Cleveland, Ohio, September 10-14, 1923)

KNOWLEDGE which we now have regarding the physical well-being of the race tends to show that a large part of the future work of medicine and dentistry lies along the road of education—the education of the public, so that, by the application of certain established facts, they may be able to safeguard themselves from a large percentage of bodily ills, thereby not only lengthening their lives, but also by improving their state of health and increasing their capacity for both work and pleasure.

Much excellent educational work in the field of public health has been done and is being done. Anyone who has practiced dentistry for a half score years or more must be impressed by the changed attitude of the patient now as compared with a few years ago. Despite the improvement, we are told that the dental condition is becoming more and more serious. Such a condition would be quite disheartening were it not for the evidence at hand that a large percentage of the dental diseases can be prevented by the utilization of well proved dietetic knowledge and by the proper observance of the fundamental principles of mouth hygiene.

Believing this to be true, the proposition resolves itself into one of determining the best method of disseminating this information to the best advantage, so that it may reach the largest number of people with the smallest expenditure of effort and means.

An independent project with such a purpose in view would entail great expense and an organization so large that it would become impracticable. An independent project is not necessary, however. The work is educational, and we already have an organized school system to give instruction where it will reach the largest number and at an age when the individual is most susceptible to it. Why not utilize this system for the promulgation of our cause?

The possibility of making oral hygiene an integral part of the course of study in the schools has been in my mind for a long time. In 1922, the Oral Hygiene Committee of the North Dakota State Dental Association suggested the thought to the state superintendent of public instruction. After a careful consideration of the matter, Miss Nielson endorsed the plan and agreed to introduce the subject of oral hygiene into the public schools, on an equal plane with other studies, provided the state dental association would formulate the working program.

Our committee realized from the first that so great a problem could not be solved in a single year, but we believed the plan to be fundamentally sound and of inestimable value. The comprehensive education of the public in this phase of hygiene should have an important

bearing on their future welfare. We therefore accepted the first available opening.

Our next task was to secure the interest and cooperation of the seven thousand teachers of the state. To convey the information to them, so that they could carry on in the schools, was a problem worthy of solution.

The Oral Hygiene Committee consisted of five members. The state was divided into as many districts and a member of the committee was assigned to each district of ten counties. The dentists of these counties were organized into teaching units and gave instruction and delivered lectures at the various county institutes. Uniformity of instruction was observed throughout the state; even standardized brushes were used in the toothbrush drills, making but little variance in the work.

This summer, similar work, though on a more extensive scale, was given at the state normal schools. A course of study is also being developed for the county school nurses. The nurses assimilate this instruction readily, and, in turn, render valuable aid to the teachers by assisting in the work as they visit the schools.

The committee is of the opinion that the dental profession should be relieved of any direct contact with the public in this educational field. The real opportunity is to aline ourselves with the department of education, acting chiefly in an advisory capacity and keeping well in the background.

The outstanding problem confronting any agency engaged in work for public betterment is the problem of informing the people of their needs in such a way that their full cooperation may be secured in developing and executing the program which proposes to improve their condition. Much well-intentioned effort in popular health education fails because the laity often questions the motives behind the work and is apt to be slow in comprehending the real purpose.

A corps of trained public health workers with ability to teach are quite as capable of doing the work in the summer schools and institutes as the dentists, who are usually occupied with their own practice. Under such a plan, the profession is relieved of possible criticism, while the community accepts the teaching without question. Thus, the instruction goes on during the entire school session, and year after year. The expense is reduced to a minimum and it is placed where it rightfully belongs—on the taxpayers in general and not on the profession in particular.

It is urged, therefore, that the dental profession, in introducing the subject of oral hygiene, place the responsibility in the schools, relieving the profession of a heavy obligation. The profession, however, must participate in the training of instructors qualified to master the subject and in the development of a general interest and understanding of it among the teaching group. The dental associations might well consider the question of encouraging in every way the training of leaders, who in turn could reach classes of teachers. The public health nurses and dental hygienists are undoubtedly the most valuable sources which we now have, and from their ranks these special instructors can be recruited.

The other problem with which we were confronted was that of securing suitable material for teaching purposes. A textbook was prepared for use in the fifth and sixth grades, and served the dual purpose of a text for the child and a reference book for the teacher. Charts and posters have been prepared so that each schoolroom in the state will be equipped to further visual education in the principles of nutrition and the home care of the mouth. The teachers, by referring to the textbook, can use these posters for teaching the young children in the lower grades.

The work is yet in an experimental stage, but it has already won a response

in the schools which is indicative of its ultimate success. The broad vision of the educators of the state in accepting the plan, and their cooperation in working out the details, gives us courage to develop further the work during the coming year.

Judging from present prospects, it seems entirely reasonable to believe that the fathers and mothers of the future will be so well versed in the essentials of healthful and happy living that the responsibility for their children's welfare will rest where it rightfully belongs—with the parents themselves.

Until such time, then, let us use our united efforts in sponsoring the cause by establishing the subject of oral hygiene in the schools throughout the country as a regular course of study, thus offering all possible knowledge on a subject sufficiently important to have a direct bearing on the welfare of the nation.

Discussion

E. S. Braithwaite, Willard, Ohio: In a recent magazine appeared this caption: "It's fine to have ideas—but can you put them over?" In connection with the problem under consideration, we believe that this idea *can* be, in every state of the Union, because the idea has been tested and rings true. I will confine my remarks to an urgent plea, and with reasons, for the adoption of the program as presented in Dr. Towne's address by the mouth hygiene committees of all the state components of the American Dental Association. Dakota is a Sioux Indian word and means "alliance of friends"; I am sure we shall make no mistake in allying ourselves with these Western friends in this great work.

With an experience of about fifteen years along educational lines having to do with mouth hygiene and preventive dentistry, and having been a member of the Educational and Mouth Hygiene Committee of the Ohio State Dental Society for about ten years, and after having thoroughly studied Dr. Towne's paper, I am persuaded that "introducing mouth hygiene into the public schools as a course of study" is *the practical* course to pursue. From consideration of the knowledge brought to our attention during these recent years, I believe that a comprehensive course in dietetics should also be closely allied to such a mouth hygiene course, for "a large percentage of dental diseases can be prevented by the utilization of well proved dietetic knowledge and by the proper observance of the fundamental principles of mouth hygiene."

Some of you may contend that personal contact with our patients in the dental office is the best avenue of education. This *is* a very good way, but do you realize that there are not enough dentists in the United States to care for more than 25,000,000 people, with no chance for contact with the other 90,000,000? Others of you may suggest other methods of education, such as talks before parent-teacher associations. It is true that there are many good ways of reaching the people with the message of mouth hygiene. In our experience, we have tried about fifteen different avenues of approach, but all of them taken together could not begin to parallel in practical results this one method of reaching the child during the impressionable age through a course in mouth hygiene in the public schools.

After all of our educational work and effort, you all know that the regular stereotyped expression of the average patient, following an educational talk at the chair is: "Nobody ever has told me before."

Let us establish the subject of mouth hygiene in the schools all over the land and have mouth hygiene's story repeated o'er and o'er.

"Till none can say of the children of men
Nobody ever has told me before!"

With our present methods we are simply touching the edges of the problem of educating the masses concerning mouth hygiene.

The average person of today is densely ignorant of the far-reaching advantages for their own physical well-being resulting from the use of present-day dietetic knowledge, and of the practice of mouth hygiene in the home. I say this advisedly. Let me present proof by illustration. A prominent woman came to me for examination and prophylaxis. The patient happened to be president of one of the leading literary clubs of the city, and a little later was president of the City Federation of Women's Clubs. In the course of our conversation, and in attempting to spread the gospel of mouth hygiene, I inquired as to whether she would care to have an address on "Mouth Hygiene and Preventive Dentistry" made before her club. "Oh, no," she replied, "Our club does not need anything like that. Only one or two of us have children and the rest don't need such a talk." And at that very moment I was removing a tartar deposit, between ¼ and ½ inch thick, from the molar teeth in that club president's own mouth!

This spring I asked another prominent woman, the president of a City Federation of

Women's Clubs, what she thought of introducing mouth hygiene into the public schools as a course of study. She replied: "I don't believe that is necessary at all," and continued, "I believe that the educational literature being put out by Colgate's is sufficient."

And you all know the drama which is being enacted by the teeth and the health of these cases which have been cited. You all have similar cases in your own practices.

They are lopping about ten years from their "length of days," and making themselves less efficient while they are yet with us, and all through the ignorance of the deleterious effects of pyorrhea and other preventable mouth diseases.

Do these people (and their number is legion) realize that "there are today over 5,000,000 children, under school age in the United States, afflicted with heart disease, most of which is due to infected teeth or tonsils, or both?" Do they realize that "proper prophylaxis of the mouth, including interdental cleansing, will cut down death from kidney disease by one-half?" Do they realize that "the highest degree of efficiency and health can not be maintained without good teeth and a clean condition of the mouth?" Do they know that "90 per cent of focal infection is above the collar?" Do they know that "only 10 per cent of the school children of the country have anything like perfect teeth?" Do they know that sixty-four systemic diseases have been traced directly or indirectly to a lack of mouth hygiene?"

However, during the last few months it has been my privilege to have come in touch with some of the leading educators in our country, and I have found a very excellent unanimous spirit of willingness for cooperation with the dental associations among those leaders in education. Through this avenue lies our opportunity for carrying the gospel of mouth hygiene to the masses in a *practical way*.

The great mission of our profession is, and rightly should be, that of *service*. In equipping ourselves for this service, we have also shouldered a greater responsibility toward our fellow men. "For unto whomsoever much (of knowledge or ability) is given, of him shall much be required."

Another new day is upon us. The tremendous responsibility of safeguarding the physical well-being of our people, by disseminating the principles and practice of preventive dentistry and mouth hygiene, and of modern dietetic knowledge, is the greater part *now* required of us. This problem is the next great step in preventive medicine which the dental profession has been challenged to take by our great surgeon friend, Charles Mayo.

"Where there is no *vision*, the people perish." Dr. Towne and the Oral Hygiene Committee of the North Dakota State Dental Association have caught the vision, and its practicability having been proved, Dr. Towne has laid it before us today in detail, for consideration, approval, and, I trust, adoption. These friendly allies from North Dakota have blazed the trail.

As I view the situation, Dr. Towne has presented to us the open door through which we of the other states must pass, if we prove true to our trust in the discharge of our obligations to mankind.

For the sake of bringing the problem more clearly before the session, I would ask Dr. Towne five questions:

1. What expense was entailed in putting the idea across?
2. Explain more fully the psychology of the idea.
3. Who are the proper authorities to approach?
4. How effective are the public health nurses and oral hygienists in carrying on the work?
5. What material is used for teaching?

If our mouth hygiene committees from the several states should return home from this meeting determined to carry the message—not to Garcia, but to their respective state departments of education—in such a way as to obtain the same splendid cooperation as was given in North Dakota, the sixty-fifth annual meeting of the American Dental Association would go down in history as having taken one of the greatest steps forward ever taken in preventive medicine and preventive dentistry.

Let us work while it is yet day, for this is our task and our night cometh.

S. R. Meaker, New York City: It has been my privilege for the past few years to direct the oral hygiene work in the education department of New York State. I have contended for this very thing that Dr. Towne has accomplished so much, even against the advice of many, in both the dental and educational professions. I have grown up with the oral hygiene movement, but hope not to grow too old to continue fighting for it. When we first realized that the mouth of nearly every child was a filthy place, the first thought was to clean it all up. We started clinics, but the great majority of such have failed to give much satisfaction because they were established on unsound principles—gratuitous service by the dental profession for one thing. It was splendid to show what dentistry could do by cleaning up a child's mouth, but sufficient mental impression was not made on either

child or parent. Thus we are convinced that much time, energy and expense can be saved, if men just starting this work do not undertake to do reparative work. We find employment of the dental hygienist in school work most effective. She gives personal instruction while doing the prophylactic cleaning, gives classroom talks and does some follow-up work. I have reports showing that more actual reparative work has been secured by this means than through offering free service at a clinic. It is all a matter of appreciation of the value of proper mouth care.

I agree with Dr. Towne that the dental profession should take a back seat in this educational matter. I have found dentists very poor teachers. The plan he suggests of a course of dental education for both children and teachers is very good. Teachers should be prepared for this work in the normal schools. We have done that to some, but to a very limited, extent. Teachers throughout the state who have been in school work for a number of years are crying for information on this mouth question. School nurses and physicians are also interested because they see the actual conditions. The principles of the normal schools and teacher training classes are reticent about giving time for this subject; they still need convincing of its efficacy.

Dr. Towne (Closing): In reply to Dr. Braithwaite's questions:

1. The expense has not been large. We have 185 members in our state association, and there is a levy of $2.00 on the membership fees from each member for oral hygiene work. The expense last year was less than the amount of the levy.

2. The psychology of the idea is good. The school people especially have cooperated well, and lay people generally see the logic of it.

3. The first step was to present the idea to the state superintendent of public instruction and the state board of health. The endorsement of the idea by the educational department was what made the project possible.

Miss O'Neill mentioned in her paper before this section the advantage of a privately endowed organization conducting such work rather than one supported by public funds. We feel that it is an educational problem and therefore should be an integral part of the school system. Once the department of education accepts the idea, organized dentistry should have enough influence to help develop the proper attitude on the part of the public.

I believe that the crying need of all health teaching today is standardization of methods. A state-wide school system allied and cooperating with organized dentistry should have an advantage in this respect over privately endowed projects.

Some school authorities might be slow to take up such a proposition, but, equipped with the mass of statistical material available from the work of Dr. Fones of Bridgeport, we should be able to convince them.

It has been the aim to make the instruction simple and comprehensive. Many teachers have a keen interest in the work; however, too much should not be expected in the beginning, yet it is surprising what some of them are accomplishing in this phase of educational work.

4. Thus far, we have no oral hygienists in our state, but we have found that by giving the school nurses some dental training, they are very valuable. They show keen interest and do excellent work.

5. The material used in the school includes a textbook, charts and posters. Special attention is given to nutrition, which is no doubt the great outstanding problem in preventive dentistry.

THE PHILOSOPHY UNDERLYING THE PROCESSES OF MOUTH NUTRITION

By THOMAS B. HARTZELL, M.D., D.M.D., Minneapolis, Minnesota

(Read before the American Dental Association, Cleveland Ohio, September 10-14, 1923)

NUTRITION in its world application reaches every living thing. Henrik Van Loon says that the history of mankind is the record of a hungry creature in search of food. The characters of nations are made or governed by their sources of nutrition. The fate of nations is frequently determined by their ability to gain sustenance. The lack of food drove the Jews into Egypt, and the power to control the nutrition of the people has frequently determined their allegiance to one dynasty or another. Perhaps the most colossal example of modern times was the shutting off of the food supply of Germany durin the Great War, for its resultant effects still obtain. The pathologic injuries wrought among the Germans by interference with their food supply was paralleled in some ways among her surrounding neighbors. This is evidenced by the deprivation diseases which became common among the children of the Danes, who robbed themselves of butterfat to supply the Germans.[1] Food supply and its sources tell us much of the character of a people. An accurate knowledge of the food supply of a nation will enable any modern pathologist to state with a fair degree of accuracy the character of disease and pathologic conditions that may be found among that people. It is a fair statement to say that more people in the world are interested in production, manufacture and distribution of nutritive or food material than in all other occupations combined. The status of the individual in the esteem of his fellow men and in his opportunities for advancement is not infrequently determined by his or her method of taking food. No lesser journal than the Literary Digest devoted two and a half pages to a discussion of the combined subjects "Cupcuddling, Harpooning and Other Table Horrors," with suitable illustrations to convey by pictures how bad table manners militate against the individual so unfortunate as to possess them.[2]

The slow changes wrought in the character of the foodstuffs supplying a nation bring with them equally important changes in the energy, resistance or lack of resistance to certain types of diseases of such people. This can readily be seen when one glances back over the histories of nations, particularly where a record of their health conditions can be obtained. One of the most interesting books to the student of pathology of modern times is the *Paleo-pathology of Ancient Egypt,* by Sir Armand Marc Ruffer, who lost his life during the Great War. In this book, Dr. Ruffer has brought to our attention his studies

1. McCollum's Newer Nutrition, pp. 256-257.

2. Literary Digest, May 26, 1923, pp. 38-42.

of the pathologic conditions readily to be seen in the mumified remains of the Egyptians. Many of the records left in the bones and tissues of this ancient people show as clearly to the eye of the trained pathologist the etiology of their diseases as would an examination of the tissues at a recent postmortem. The dental lesions and the bony lesions of the jaws appear to be the same in every particular as those found among the starch and carbohydrate eating peoples of today. We find the same rickety bones and the evidence of tuberculous lesions, as clearly recorded and as evident to the eye as though the deaths were but yesterday. The gradual changes in the pathology of our people, when studied in the light of their alimentation, point clearly to the fact that the change from simple foods containing much valuable roughage to highly refined food from which the valuable roughage has been eliminated has left and will continue to leave a record in the health of this nation which will only be changed by the education of the people as to what these death and disease-producing conditions are and the reason for them.

Economic conditions in the production of food and economic conditions controlling the power to purchase food and the enormous investment of money in food refining and preserving processes are steadily altering the diet of our people to their hurt, for the food of the laborer is determined by his lack of knowledge of what to buy and his limited power to purchase. The fact that all kinds of carbohydrate foods manufactured and highly refined can be purchased for relatively much less money than proteins, fresh vegetables and fruits, has slowly changed the dietary character of all classes so that starch and sugar constitute more than half of their total diet. We consume millions of tons of concentrated candies, confections, syrups and sweets of all kinds. McCann, in his book "*Science of Eating*," makes the claim that the consumption of sugars and glucose has reached the enormous figure of 150 pounds per capita a year. In fact, the consumption of sugars and sweets is distinctly on the increase. It is not improbable that the passage of the eighteenth amendment, prohibiting the manufacture and use of alcohol as a beverage, has aided in increasing the consumption of sugar. It is a known fact that persons accustomed to alcoholic stimulants turn readily to sugars as a substitute, which, in part, relieves the desire for alcohol. Please do not understand me to decry the use of carbohydrate foods in their proper proportion. I do believe, however, that the consumption of carbohydrate foods, for the reasons given above, has increased beyond sane limits; and I know of no better way to secure the cooperation of people to limit, in some measure, that excess consumption than to teach them its true value. We must also teach that to secure the benefit of these carbohydrate foods we must, no matter in what form in which we ingest them, do the major part of their reduction from disaccharides to monosaccharides by thorough mastication which insures insalivation and the splitting of these indigestible sugars to easily assimilated material by thoroughly placing them in contact with saliva in the mouth.

It is a distinct evidence of interest and growth that a great section of our American Dental Association devoted to the study of the mechanical problem of prosthesis gives up time for a paper and its discussion to the problem of nutrition. It shows that the modern prosthetist is looking beyond the question of merely supplying lost parts; that the question of why the teeth are lost is interesting him more and more; and it shows, too, that our prosthetists are beginning to appreciate the fact that the mere restora-

tion of lost teeth is not the only thing that he can do to bring the patient back to health. Unquestionably, the loss of teeth depends largely on malnutrition, which in many instances may date back to the child in utero; if the mother has, through lack of power to masticate, been compelled to do without foods containing the necessary mineral and vitamin content, the child born from such a mother must of necessity be handicapped. And I want to make the point right here that when an exodontist clears the mouth of the diseased remains of the denture of such a mother, the prosthetist, in restoring function to the jaws by introducing artificial teeth, has only in part completed his task. If we as prosthetists wish to contribute our full share to the rebuilding of the health of such persons, we must teach them what to eat with the restored teeth and how to get the greatest return in energy and health from food so eaten.

It has always been the ambition of prosthetic dentistry to restore the beauty of the face and form, and the remarkable progress of the last five years shows that the restoration of function also has reached an almost unbelievable degree of perfection. If now we attack our problem in the light of pathology so plainly evident in the cases we are called on to treat, we will, most of us, I hope, be willing to carry our work with our patients on into the field of nutrition. When we have a case in which the present health of the patient and the past case history show deprivation, let us look into such a case history and determine just why and how this deprivation happened. I find in my own experience that the loss of a single tooth or the presence of an exposed pulp has led the patient to eliminate certain foods which irritated the exposed pulp or the sore tooth; and the bad food habit, brought about, in the first place, by the pathologic condition present, is oftentimes maintained through later life, thus establishing deprivation disease on such a firm foundation that even though the person has had the denture entirely perfected, the food habit thus established continues to evidence itself in continued disease or lack of health. I believe every one of us can look back through the vista of years and recall cases of the type I am describing, and will recognize the fact that such conditions have oftentimes passed through our hands unnoted, and I believe there is no greater service that we, as a dental profession, can render to those who seek our aid than briefly and efficiently to instruct them in the art of eating, for eating is a fine art. It is quite true that we Americans, who live so fast, have lost much by reason of our haste, and one of the things we have lost has been the art of eating. There is no single piece of training that our profession could carry to the people whom we serve as important as direct and simple instruction in the chemistry as well as the mechanics of mouth nutrition. I maintain that the person who, having lost his dental mechanism through disease, has as a rule so warped his appetite and desire for a normal dietary that, even though we prosthetists have completely restored his dental mechanism, he fails to make the gain in health that the renewed power to chew food properly should give him, and the pathologic conditions maintained as a result of previous difficulties continue to exist. This is a class of people that will benefit most by training which no one should be better fitted to give than the prosthetic dentist who restores the mouth to function. And the dentist who treats a case of this kind and neglects to teach the patient how to use his teeth no matter whether or not they occlude with absolute perfection or the power of mastication be restored in

such a manner that deglutition is normal, and who does not instruct the patient as to the value of his salivary outpour and how to gain it by chewing, and what it will do when correctly conserved, falls short of rendering the greatest service to his patient.

I maintain that the subject of the mechanics of mouth digestion belongs absolutely in the dental field, and I further maintain that the dentist, as a member of the family devoted to the healing art, owes it to himself and his clientele to teach the important facts concerning digestion and nutrition which should be common knowledge to every person, and which, unfortunately, are known by very few. To that end, I can do no greater service in this short paper than to discuss briefly this subject and call back to your minds in as logical a manner as I am capable of, the facts regarding nutrition that I have found of greatest value to my patients. That this will not be inappropriate would seem to be true when we note the keen appreciation that has been accorded to the work of such men as McCollum of Baltimore, Seccombe of Toronto, Howe of Boston, and Grieves of Baltimore, to all of whom we owe much. In attempting to set this information in form before you, I intend to pursue exactly the line of thought which I follow with a patient who I find needs instruction. The intelligent American patient may be depended on to do anything which his reason convinces him is worth while, and, on the contrary, will rarely ever follow directions given by a physician or dentist unless he believes such directions are of absolute and positive value. On the other hand, if, in giving him instructions for his own good, the dentist sets forth his facts in a sufficiently interesting and convincing way, the patient will not only be glad, but anxious, to follow the dentist's line of thought and apply it to his own good. To that end I teach the patient that health is the normal condition of the body, that health depends on food translated into healthy living tissue and energy, and that to correct conditions of disease, we should seek, first, to solve the reason for such disease, maintaining that disease is often dependent on the fact that the body has been improperly fed. Many of us are now coming to believe that the high immunity which certain persons possess, that great resistance to the invasion of bacteria, and the great energy and power to work present in them, is found only in those persons who have been supplied the material to create the perfectly normal body; and that it is just as illogical to secure this ideal state when the food supply is unbalanced as it is to expect a fireproof building to be made of wood. The person who consumes a balanced ration, containing sufficient water, sufficient protein, sufficient fat, sufficient mineral content, and sufficient carbohydrate material in proper balance, and who takes this, too, under conditions of proper mastication and insalivation, will create tissue cells which will do the maximum amount of work and have the greatest possible resistance to physical tire and bacterial invasion. We must not, however, overlook the fact that there must be, in addition to the elements mentioned above, enough insoluble cellulose to give the muscles of the digestive tract work to do. Perhaps the man who has contributed more stimulus than any other on this subject and who has written most interestingly was Mr. Horace Fletcher, whose books reached a wide circulation, particularly his book the "*A. B.-Z. of Our Own Nutrition.*" However, he overlooked the fact that in balancing the food requirements it was just as necessary to supply the body with certain indigestible material to maintain healthy muscle activity of the bowels as to supply the

highly nutritious material, and he died of atony of the bowel for lack of it, we are told. For the patient's instruction, we should call to mind that the digestive tract is roughly divided into three divisions, each division performing certain definite services, and it is just at this point that the patient who is in need of instruction should have the fact driven home that the mouth contains the mechanism for crushing the food, and for reducing all the carbohydrates or starchy foods from indigestible useless starch to energy-making sugar. The importance of the mouth and its service can be accentuated by pointing out the fact that the carbohydrate portion of the diet contributes the energy-making power; that it is, in fact, the gasoline to the human engine; that the blood at all times should contain at least 0.08 of 1 per cent of dextrose sugar, derived from the starches and sugars, and it may in health rise to from 0.15 to 0.2 of 1 per cent.[3] We should remember, too, that the stomach has absolutely no power to reduce starches to sugar, unless such starches are first perfectly mixed with saliva. We should also keep clearly in mind that starches introduced into the stomach without first having been changed to maltose by the saliva behave as an actual irritant to the stomach, stimulating useless labor on the part of that organ, in fact, worse than useless labor, because the ingestion of a starch meal not only uses up valuable stomach muscle energy, but it induces an outpouring of hydrochloric acid, pepsin and renin, which have no effect on raw starch, and the acid absolutely deters and delays the digestion of starch in the intestine until such time as the intestinal membranes and pancreas can neutralize the acid uselessly produced by the stomach in its attempt to digest an indigestible (in that organ) substance. Of course, we know that carbohydrates, if thoroughly mixed with saliva in the mouth, can continue inversion in the stomach for several moments.

The great importance of the foregoing statements were much impressed on my mind in a recent discussion with a patient who was evidently suffering from a definite overproduction of hydrochloric acid, which seemed to be associated with gastric ulcer. In cases of this type, I always insist on very careful insalivation of starches to avoid stimulating an overproduction of hydrochloric acid. Following my exhortation to be careful to insalivate starches and to limit starchy food for the time being, the patient made the following observation: "It will be necessary to give that matter real thought, as we have a great deal of starchy food on our table," stating that the day before they had served bread, potatoes, rice with cream, and spaghetti, together with a vegetable and fowl, and topped off the meal with cake. In this one will note five starch foods, one protein and a leafy-top vegetable; so one can see that in instructing this patient how to get the value with no harm out of her starches, I was contributing a very helpful service. This patient, by the way, is a matron in an institution for girls, so that my advice in regard to balancing the ration and utilizing the ration so balanced, perhaps, will bear more fruit than such advice generally does.

Do not understand me to object to the use of carbohydrate foods. They are immensely valuable in that they do produce energy, and the body tends to utilize from them what it needs, and stores the excess dextrose, in the form of glycogen, in the liver. In fact, fat stored up in the body, and the glycogen, may be likened to the gasoline in the tank of the engine. William Russell,[4] twenty

3. Mathews: Physiological Chemistry, Ed. 2, p. 470.

4. The Lancet, March 21, 1903, p. 806; also A. B.-Z. of Our Own Nutrition, p. 145.

years ago, drew attention to the fact that starch remained in the stomach oftentimes for a long time, and that in that condition it was an irritant. A large number of those dyspepsias in which an excess of hydrochloric acid is found depend, I believe, on the abuse of the stomach with undigested starch, and here the prosthetist, in instructing his patient, should show the value of masticating all starchy foods, even those which are so well cooked and soft that they seem to need no mastication. We should teach that the work of the stomach is preeminently that of digestion of proteins, albumins, casein, etc., and the fats and those carbohydrates not inverted by ptyalin are digested in the small intestine. Certain of our physiologists believe that absorption of reduction sugars can occur along the whole intestinal tract to some degree, although the greatest absorption occurs through the medium of the lacteals in the small intestines. When starchy food fails to digest in the intestines by reason of the fact that it has been so vigorously acidulated in the stomach, it may pass through the small bowel and undergo fermentation, thus creating a food for bacteria and producing damaging poisons evidenced by a malodorous stool, which does not occur if mastication and digestion are perfect. So we see that the value of thorough mastication and insalivation of starchy foods in the mouth is infinitely greater than would appear to the casual observer. Especially is this true of the workers in the great cities. As our population increases, more and more people flock into the cities, and the feeding of the city worker is becoming an increasingly great problem. One of the fundamental reasons for the enormous increase in the consumption of carbohydrate food is that grain and potatoes can be grown thousands of miles from the point of consumption and will keep for long periods of time when shipped, whereas leafy-top vegetables and meat require quick handling and icing to prevent decomposition. On account of this fact, their costs are increased, so we may confidently expect a greater consumption of carbohydrate foods in the future than in the present, and the intelligent use of them becomes increasingly important.

The value of the mechanical treatment of food in the mouth by thorough mastication is aptly illustrated in the following manner: Let us concede, to begin with, that finely divided food is more easily attacked by the digestive juices than coarse lumps. To bring this home to the individual, let us imagine for the moment that one might swallow a cubic inch of some food. Such a mass would present 6 square inches of surface to the solvent action of saliva or gastric juice, as the case might be. If the cube happened to be starch, it would merely be wet upon the surface with saliva, which surface would soon be wet by gastric juice upon entering the stomach, which in turn would neutralize the saliva and all digestion would then cease, as we know that starch cannot be attacked nor inverted by gastric juice alone. If this cubic inch of food were meat, the gastric juice would attack it slowly from the surface, and, in the course of time, completely liquify it, during which period the muscular activity of the stomach would be uselessly overspent. Compare this state of affairs now with the same cubic inch of food, be it starch or meat, which, let us say, had been previously divided into small cubes, 1/100 of an inch square. We would now have a surface open to attack by either saliva or gastric juice equivalent to 600 square inches. I have shown in a previous paper[5] that starch so carefully reduced

5. Hartzell, Thomas B.: Showing the Possibilities of Starch Digestion in the Mouth, Journal American Dental Association, January, 1923.

in the case of white bread will have changed 33 out of a possible 45 per cent to sugar in twelve minutes, and that in the case of salivary digestion on soda cracker, 70 parts out of a total of 95 parts will be changed to maltose in five minutes, and that in the case of digestion of cold boiled potato, 20 parts out of a possible 25 parts is changed from starch as such to maltose in five minutes, when the starch is finally divided in saliva. It becomes evident, therefore, no matter what the character of food, be it a food properly digested in saliva, in gastric juice, or by pancreatic juice or succus entericus of the small intestines, that the fine subdivision of it enormously increases the ease with which the digestive juices reduce it to liquid. It must be kept clearly in mind that no single particle of food, save water, is ever received into the body for tissue building in the state in which it is ingested. All other foods must undergo chemical disintegration in the digestive juices and be resynthetized into the character of tissue demanded by the physical body through a physicochemical process which demands complete liquefaction before these chemical changes can occur.

It so often happens with a person who has lost the habit of mastication by reason of decayed or abscessed teeth that even when comfortable, efficient artificial teeth are placed, he prizes them chiefly for the added beauty they give the countenance and frequently fails to utilize their masticating and digestive power, particularly on that type of foods which includes the sugars and starches that can be swallowed without mastication. And, for that reason, it seems to me that the prosthetist ought to teach his patient to begin the efficient mastication of all starchy foods, thus leading him by general steps to the habit of mastication of the coarser and harder foods. At this point, let me add one more reason for insisting on the mastication of starches, which I believe will tend to limit their use. This is the fact that the diabetes death rate increased 10 per cent in 1922. My authority for that statement is a statistical bulletin put out by the Metropolitan Life Insurance Company in January, 1923. This bulletin further comments on the diabetes mortality increase as follows: "There seems to be a rough correspondence between rises in the per capita figure for raw sugar consumed in the United States and the death rate from diabetes, especially during the last four years. It may be possible, also, that the increased consumption of beverages containing high percentages of unfermented malt sugar, and of confections, may be contributing factors to the recent increase of the diabetes death rate."

The advantages to be gained through a perfect understanding of the value of mastication and the insalivation of good food might be briefly summarized as follows: For the mature person, first, a distinct lessening of the amount of food ingested, over what usually the person needs to ingest if the food is bolted. This means greater energy and a greater amount of tissue built with less chemistry in the digesting of it, and less chemical activity in the building of it into the tissues where it is needed, and, in turn, an increased saving through the lessened amount of waste material created as a result of breaking down this same tissue and eliminating it through the kidneys, skin, lungs and bowels—in a word, greater value for less expenditure, a double-edged economy. For the growing child, many added benefits may be noted, so many that I scarcely know where to begin to enumerate them. 1. Perfect mastication and insalivation of all foods means the same saving in energy and the same gain in relieving the body of the burden of elimination as we expect to find in the

adult, and in addition to that fundamental gain, we have through thorough mastication the stimulation of, and development of, better and more active salivary glands. Our physiologists tell us that the normal amount of saliva created for the twenty-four-hour period may be not less than two liters. Such a vigorous development of salivary glands will not occur if mastication is habitually neglected. 2. The nutrition of the jaws will be so increased through their activity that the bony structure and alveolar process will be increasingly perfect in proportion as the jaws and teeth are vigorously used. 3. Occlusion of the teeth is much more apt to be normal in jaws that receive regular and vigorous exercise than in the jaws of the person who fails to give them normal activity. 4. The bones of the base of the skull grow in conjunction with the mandible. The more vigorous the activity of the muscles of mastication, the broader and better will be the development of the base of the brain and its bony protection. It is a notable fact that when the sella turcica is small, the pituitary gland is of necessity poorly developed, and this tends to lessen cerebral activity. Dr. Timme of New York, whose service during the War was that of a neurologist, stated, in a lecture delivered in Minneapolis shortly following the war, that he repeatedly studied persons who fell asleep at military posts while on duty, who complained of the fact that they simply could not maintain themselves awake, thus incurring severe penalty, but who could, when supplied with pituitrin, maintain themselves awake and become normal persons. Some of these same men, when carefully examined by roentgen rays, evidenced small sella turcicas and often complained of severe headaches. Dr. Timme believes that he has evidence to show that, in radiographic pictures of the base of the skull in cases of this type, the pituitary body is so crowded that its growth and function are interfered with. He shows other radiographic pictures where, through the gradual growth and development of the pituitary body in these small saddles, the horns of the saddle become resorbed and the pituitary body escapes the pressures endured in the small sella turcica, following which the person becomes normally well. So that it seems to me that the chances of developing a good, vigorous skull is greatly increased by the constant exercise of the powerful masticatory muscles, and that we might expect this benefit also as a result of proper mastication. This may seem chimerical to those who have not kept pace with the research and observation as to what the endocrine glands do for the individual; nevertheless, it seems to me worth noting here. MacHarrison stated in a recent article[6] that in a study of health conditions by an English health officer he estimates that 25 per cent of the diseases of the British people is due to diseases of the gastro-intestinal tract. Certainly, by perfect mastication of foods, thus reducing the bulk of them to liquids, running hand in hand with the proper selection of foods, a large proportion of these gastro-intestinal diseases would be obviated; and none can contribute more to this desirable end than the dentist, if he chooses to use the accumulated knowledge in this field now at his disposal.

Discussion

Wallace Seccombe, Toronto, Canada: Dr. Hartzell has marshalled in an interesting manner the arguments in favor of thorough mastication and insalivation of food, and has drawn attention to the fact that these advantages accrue to the individual, whether the natural teeth or prosthetic substitutes are used in the process. Conceptions such as this lift prosthodontia from the plane of mechanics to its rightful place as an important health service. Prosthetists have too frequently thought of their work in terms of "appliances" and

6. MacHarrison: J. A. M. A. 78: 1-8 (Jan. 7) 1922.

"cases," instead of considering each restoration fundamentally as a service for the benefit of the patient's health. Such a point of view entirely changes the operator's attitude and leads to the esthetic possibilities of a denture being fully developed but never at the expense of efficiency in mastication.

One is quite justified in stating that the wonderful advances made in the past few years, both in full and partial denture prosthesis, have been not only a triumph in mechanical skill, but a definite forward step in public health.

Some members of the dental profession may entirely disagree with Dr. Hartzell on the proposition that the prosthetist should carry his work into the field of nutrition. But we must bear in mind that every dental licentiate, whether he be general practitioner or specialist, is expected to put into practice the principles of prevention. Preventive dentistry is, in effect, oral physiology, and as such is just as fundamental to dental practice as is oral pathology or oral anatomy. Then why should not the prosthetist in serving even an edentulous patient think of the service he is rendering in terms of health and prevention? Should this view prevail, the prosthetist must of necessity interest himself in the problem of why teeth are lost, and, following their restoration, teach his patient how to eat, what to eat, and how to give hygienic care to the oral cavity, including prosthetic appliances.

I agree entirely with Dr. Hartzell regarding the need for the thorough mastication of food, and particularly of the starches, in order that they may be well insalivated, but I cannot agree with the statement that starches introduced into the stomach without having first been changed to maltose by the saliva behave as an actual irritant to the stomach; that starch in the stomach induces an outpouring of hydrochloric acid, pepsin, and renin, and that overproduction of hydrochloric acid in the stomach may be due to this cause; and that when starchy food fails of digestion in the intestines, because of being overacidulated, it may pass through the small bowel and undergo fermentation, create food for bacteria, and produce damaging poisons. These arguments might lead one to the erroneous conclusion that all starch digestion must be completed in the mouth.

Pavlov, the great Russian physiologist, has amply demonstrated experimentally that each kind of food calls forth a particular activity of the digestive glands with varying properties in the juices supplied, and this is just as true of gastric juice as it is of saliva. The secretion of gastric juice is stimulated not by starch but by the presence in the stomach of protein. It would be contrary to physiologic law for the mere presence of starch to stimulate a flow of gastric juice. The gastric juice varies in its properties, rate and duration of flow according to the character and amount of protein food present. It is quite true that the presence of bread in the stomach stimulates a flow of gastric juice, but this is due not to the mere presence of starch, but to the protein of the bread. Khizhin reports interesting experiments in the variations in gastric juice in the digestion; for instance, of bread, meat and milk. He has shown that in the digestion of bread, the gastric juice has more of ferment and actually less of acid, and the flow of juice continues for a greater length of time. In fact, bread requires twice as much gastric ferment as meat, and four times as much ferment as milk. During the gastric digestion of bread, an excess of hydrochloric acid is actually avoided. There is an increase in the ferment because of the greater quantity required for the digestion of the vegetable protein contained in the bread, and large quantities of hydrochloric acid would be useless or possibly injurious.

The digestive tract is a wonderful chemical laboratory, and there are no more exact chemical reactions than those that occur in the human body. The wide variations in the digestive juices are constant under similar conditions, and are related definitely to the special work to be done.

One might be led to infer from Dr. Hartzell's paper that the inversion of starches occurs only in the mouth, and that after the food is swallowed, all amylolytic action ceases. It should be borne in mind, however, that there is a pause, extending from five to ten minutes, between the taking of food and the beginning of gastric secretion. During this period, the action of the ptyalin upon the starches proceeds within the stomach itself, and physiologists are agreed that the significance of this latent period, as it is termed, is to permit the continuance of starch digestion. It is well that Nature made this provision, for it would be very inconvenient, and indeed ordinarily impossible, to retain all starchy foods in the mouth long enough to permit the ptyalin to convert all of the starch into sugar. Imagine the difficulty of eating oatmeal porridge and masticating each mouthful long enough to convert all the starch into sugar!

Nature has also provided the pancreatic juice with amylolytic power, in order that starches not inverted either in the mouth or stomach may be dealt with in the bowel. This provision surely presupposes the presence of starch in the alimentary canal beyond the stomach, and Walther has shown that it is by no means necessary to provide an alkalin

medium, for the amylolytic action of pancreatic juice. The fact is that both salivary and pancreatic digestion of starch proceed best in weakly acid media.

Regarding the question of fermentation of starches in the intestines, Cannon has experimentally proved that the presence of starch in the intestines is of positive value in the control of bacterial growth, actually preventing undue putrefaction and toxic absorption.

I take it that we all sincerely believe in the thorough functioning of the masticatory machine and appreciate the importance of thorough mastication of food, particularly in these modern days of rush and hurry. But in stressing the importance of mastication, it is well for us not to use arguments that are physiologically incorrect or that are out of harmony with accepted principles.

Dr. Hartzell (closing): I am very grateful to Dr. Seccombe for treating my paper so kindly. I am very well aware that there is amylolytic action upon the starch in the small intestine. I have one very vital reason for handling the subject exactly the way I did handle it, and that reason is that I wanted to induce—and I hope I will have in some measure induced—you men to deal with the subject of mouth digestion in a more comprehensive way. It was not my purpose to explain the whole digestive process. I, too, have read Pavlov, whose last edition in our library was published in 1902, twenty-one years ago, and Cannon, published twelve years ago, and I do not accept his conclusions that starch prevents putrefaction in the bowel; and may I remind you that views change as the years pass. I have taught for thirty years, and I find when I have a definite object to attain, if I will deal with one or two principles at a time, I will attract attention to them.

While it is true that starch may be digested in the small intestine, and is digested there, I want you to practice the use of the mechanism the Lord has given you and your patients to get the full benefit of starch digestion in the mouth. There have been some great changes going on in physiology, and the experimentation done on animals, dogs, particularly, does not always tally with what happens in the human body. I listened to a paper last winter by one of the great physiologists of the United States, and it is really surprising how much physiology that he has been teaching in the last twenty years he has taken back in the last five years on his own admission.

There is nothing that succeeds like success, and when you put into operation in your clientele the ideas I have been trying to promulgate here and get positive and direct benefits immediately, and when you experience them in your own person, you begin to think that perhaps previous researches of physiologists on animals in regard to starch digestion may not have been entirely correct. Far be it from me, however, to question the sincerity of purpose of the men who have written the books that have gone before. But I remember very definitely that in the last twenty-one years we have gone through a period—we will say, in surgery—when all ovaries had to come out. We now recognize the fact that ovaries may be conserved. We went through a period in which all teeth had to be extracted that previously had lost vitality. Now the pendulum is swinging back. Tonsils are still taken out if the people sit still long enough; still there are quite a few people going around and are living with their tonsils in. I am merely bringing these little instances before you to show that there can be quite a diversity of opinion.

Coming back to the main premise, there is nothing that succeeds like success. When you put these principles that I have been driving at into operation and see marked success from them, do not question too closely the theory of the thing, but try it out as a matter of fact, and if you get the results that I know and believe you will get, you will feel justified in having followed the lead that I have tried to blaze here.

I do not believe there is anything further that I want to say. I am grateful to you for listening to me, and I hope some of you, at least, will begin to teach your patients the use of the organs of mastication, and reteach them that which they have lost through disease prior to the time they called on you. I have personally done enough work in this field to believe that my conclusions are absolutely true.

GOLD FOIL AND GOLD FOIL OPERATIONS

By EDMUND NOYES, D.D.S., F.A.C.D., Chicago, Illinois

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THE filling of teeth with gold foil, or gold leaf, is probably a very ancient operation. In Guerini's *History of Dentistry*[1], there is reproduced the title page and two text pages from an edition of Zahnarzneybuchlein (and the translation), printed by Michael Blum in Leipzig in 1530. "A marginal note refers to Mesue as the author from whom the three methods of treating caries has been derived, one of these methods being the filling of the carious cavity with gold foil."

"Mesue was surgeon to Caliph Haroun al Raschid, who flourished from 786 to 809 A. D. If the reference to Mesue is correct, it would, therefore, indicate that the filling of teeth with gold was known to the Arabs as early as the latter part of the eighth century. Examination of the writings of Mesue has thus far failed to bring to light any record therein of the treatment of caries by gold filling, although in his work previously referred to the other methods quoted by the anonymous author of Zahnarzneybuchlein are fully set forth."

The following is from the translation referred to above. "This, as Mesue writes, is chiefly cured and removed in three ways.— Third, by removing the decay, which is done in two ways, first by scraping and cleaning the hole and the carious part with a fine chisel, knife, or file, or other suitable instrument as is well-known to practitioners, and then by filling the cavity with gold leaves for the preservation of the other portion of the tooth."

This is not quite so conclusive as if it could be found in the accessible writings of Mesue, but it makes it seem probable that filling teeth with gold leaf was done by the Arabs in that long ago time.

A number of writers have asserted that gold fillings have been found in the teeth of Egyptian mummies, but diligent search has hitherto failed to find any of those mummies, and Guerini cites the celebrated Egyptologist, Prof. George Ebers; the distinguished craniologist Prof. Emil Schmidt of Leipzig, who owns a collection of several hundred mummies' skulls, and Virchow, who also examined a great many Egyptian skulls, and mummery, who made conscientious researches on the subject, but none have been able to find any evidence of the work of dentists. Guerini makes this comment: "Between the affirmations of some and the negations of others, it is very difficult to say on which side the truth lies. For my own part, I fail to find that there is the least proof of the ancient Egyptians having known how to insert gold fillings and still less to apply pivot teeth. But at the same time

I think it cannot be doubted that the Egyptian dentists knew how to apply artificial teeth. And even though it may not be possible to demonstrate this by direct proof, one is equally prone to admit it when one considers, on the one hand, the remarkable ability of the ancient Egyptians in all plastic arts, and on the other hand, the great importance they attributed to the beautifying of the human body."

"The celebrated surgeon Giovanni of Vigo (1460 to 1520) is very brief in speaking on the treatment of dental caries, doubtless because he attributed little or no value to the numerous methods of cure recommended by his predecessors. The treatment advised by him is, however, very noteworthy. He says that by means of a drill, file, scalpel, or other suitable instrument, it is necessary to remove the whole of the putrefied or corroded part of the tooth, and then, to preserve it, to fill the cavity with gold leaf"[2].

"Gerolanio Fabrizio of Aquapendente (1537 to 1619), a celebrated anatomist and surgeon, wrote some very valuable works, among which is a treatise on surgery, in which the part relative to the affections of the dental system is treated briefly, but with great orderliness and clearness, thus giving a very precise idea of what dental surgery was at the end of the sixteenth century.

"The principal operations which it is necessary to perform on teeth are, he says, seven in number, viz:

1. Forced opening of the dental arches in cases of prolonged constriction of the same, so as to prevent the patient from dying of hunger.
2. Cleaning of the teeth.
3. Medication of carious cavities.
4. Filling with gold leaf.
5. Removal or resection of teeth abnormally situated.
6. Removal of any unevenness or sharpness of the teeth.
7. Extraction.

"To arrest caries he first drops into the carious hollow, by means of a small silver funnel, some drops of oil of vitriol, or of some other caustic liquid; and then he performs actual cauterization with appropriate instruments; after which the cavity is filled with gold leaf"[3].

"Pierre Dionis[4], a celebrated surgeon and anatomist of Paris, who died in 1718, enumerates seven dental operations. One was the stopping of the carious cavity. Dionis does not enumerate this operation among those intended for the preservation of the teeth. At that period, this operation was performed solely with a view to prevent the penetration into and the retention within the carious cavity of alimentary substances, and the disadvantages caused thereby. The carious process, says the author, often ceases altogether, and the pain then generally ceases also. However, as the residual cavity often becomes troublesome in various ways, among others by making the breath offensive, it is better to stop it. For this purpose, gold or silver leaf is generally made use of; but this mode of stopping is not durable, because gold or silver in leaf is apt to become loosened and fall out. It is therefore preferable, according to Dionis, to make a stopping with a piece of gold or silver corresponding in size and shape to the cavity. Many prefer lead as a stopping on account of its softness, while others simply use wax. In a footnote, Guerini says, "Here also one verifies the absurdities pronounced by those who, not being dentists, but merely general practitioners or surgeons, still risk speaking on dental subjects."

"Lorenz Heister (1683-1758), of Frankfort-am-Maine, one of the most

celebrated surgeons of the eighteenth century, wrote a dissertation on toothache, treating, besides, very extensively of dental affections and their cure in a masterly work on surgery, published for the first time in 1718, and which went through numerous editions in various languages. When the caries of a tooth is superficial, Heister advises the removal of the decayed part with a file, or when the caries is deep down, the cavity ought to be well cleaned with a toothpick or other like instrument, then filled with heated white wax, or mastic, the stopping being renewed as often as may be necessary. When a molar tooth is decayed, especially in the center, the best way, says Heister, is to fill it with gold or lead leaf, or with a piece of the latter fitting into the cavity[5]. Here again is the surgeon talking about dentistry which he does not practice.

"Pierre Fauchard, the founder of modern scientific dentistry, was born in Brittany about the year 1690 and died in Paris in the year 1761. His celebrated work, *Le Chirurgien Dentiste*, was already written in 1723, but not published until 1728. It marks a new epoch in the history of dental art"[6]. Guerini takes forty pages in the description and illustration of Fauchard's work. What we are specially interested in now is told in a few sentences[7].

"Chapter 6 is dedicated to the stopping of decayed teeth. The sole materials used by the author for stopping were lead, tin and gold. Fine tin, he says, is preferable to lead, for lead turns black more easily and is much less durable; both are preferable to gold, because lighter and adapting themselves better to the unevenness of the carious cavities. Besides, gold being dear, not everyone can or will make the corresponding outlay." The author here adds that those who from vanity or because possessed by the opinion that gold has special virtues will not have their teeth stopped except with it not unfrequently find dentists who, as the saying goes, content them and cozen them by using leaf tin or lead colored yellow, and make them pay for it as gold stopping. The leaf materials were introduced and compressed into the carious cavities by means of three kinds of pluggers, which would nowadays be considered altogether insufficient and unfit for the purpose, but which then, nevertheless, served to produce excellent stoppings. The author speaks of a lead stopping which had lasted in perfect condition for forty years.

It is noticeable that, until Fauchard, the writers about dentistry do not appear to have been dentists, but surgeons. Such dentistry as was done appears to have been mostly by barbers, who also did some surgery, but there were occasionally educated men of ability who practiced medicine and surgery and who did the writings on these subjects that have come down to us. These men rather naturally held in very light esteem the illiterate barber dentists and their work as of little consequence in comparison to their own. This attitude of mind of the medical profession toward the dentists appears to have lasted with practical continuity until recent times. It was conspicuous in 1839 when Chapin A. Harris and his associates tried to persuade the medical school in Baltimore to give dentists an education that would make them medical specialists. It was not until the medical profession realized that infections about the teeth are a frequent cause of dangerous and sometimes fatal infections elsewhere that medical men were ready to admit that dental practice is as closely related to medical practice as that of the rhinologists, oculists and some other medical specialists, and that cooperation and mutual respect and

understanding are as necessary with dentists as with recognized medical specialists.

It may be admitted that the dental profession generally was not found very well prepared for this new development, but there has been encouraging increase of interest by dental students in the medical subjects of their courses, and not a few of the men in practice have sought the instruction or pursued the studies to qualify them for the developing professional situation.

I have never heard any date assigned for the time when gold first began to be prepared for dentists' use, and it would be interesting to know if the gold leaf mentioned by the old writers was beaten as thin as the gilders' leaf of the present day. This is beaten as thin as can be done and retain an unbroken surface, the object being to cover a given surface with the least possible amount of gold. Gold foil, on the contrary, is beaten to a definite thickness, a leaf 4 inches square weighing exactly 3, 4, 6, or any desired number of grains, and the foil is named by numbers corresponding to the grains in a sheet—for dental purposes from No. 3 to No. 120, No. 4 being mostly used. Soft foil, more properly called noncohesive foil, appears to have been the only form used until about 1854, when Robert Arthur was instrumental in introducing to the profession what was then called adhesive gold. There soon appeared a number of men who claimed a prior use. It appeared, however, that every one of them had carefully refrained from telling anybody about it. To stop the controversy, the Western Dental Society, in St. Louis in May, 1857, appointed a committee who, after a careful investigation, reported a resolution which was adopted, to the effect that to Robert Arthur, and to him alone, the profession is indebted for making known the use of adhesive gold[3]. For about fifteen years there was much speculation about the causes that made gold adhesive or that made it soft, or nonadhesive. It was known that annealing would usually make gold adhesive, but no one correctly answered the question why, until G. V. Black read a paper entitled "The Preparation of Gold Foil for Filling Teeth" in the fifth annual meeting of the Illinois State Dental Society at Quincy in May, 1869. The proceedings of the Society were published in the Missouri Dental Journal for July of that year. In preparation for this paper, Black had made a very extensive series of experiments which proved conclusively that the noncohesiveness of gold is caused by the attachment to its surface of various gases by molecular attraction in a manner similar to the way water attaches itself to any surface that can be wetted by it. Annealing drives off these adherent gases and leaves the surface chemically clean. Black pointed out that the most dangerous gases are those from sulphur and phosphorus, since these are formed by the burning of matches, and sulphur gases are exhaled from all sorts of rubber goods and in appreciable quantities in vulcanizing and in all work on rubber plates. The special danger from these gases is that gold contaminated by them is not restored and made cohesive by annealing. Ammonia gas, on the contrary, while rendering the gold perfectly noncohesive, is perfectly removed by a moderate annealing heat, somewhat below redness (though a low heat requires longer time). The surest way to have gold in perfect condition is to expose perfectly cohesive gold to ammonia gas, which makes it perfectly noncohesive, and being alkaline, the presence of the ammonia used for this purpose protects the foil from the acid gases from sulphur and phosphorus. When wanted for use, annealing perfectly restores its cohesiveness.

The work of Black described in that paper was complete and conclusive. His findings have never been disputed and nothing of consequence that I know of has been added to them.

It is noticeable that from the time of our earliest accounts of the stopping of carious teeth to the present, gold has held the first and honored place. There was, however, beginning in the latter part of 1877 and continuing many years, a strenuous and persistent effort to displace gold from its long established position. This was called "the new departure" and was based on the electrochemical theory of decay. It was developed first by the researches and observations of S. B. Palmer, of Syracuse, New York. He convinced J. Foster Flagg of Philadelphia, and Henry S. Chase of St. Louis, and those three were called "the apostles of the new departure." The fundamental and most important article of the "new departure creed" was, "In proportion as teeth *need* saving, gold is the *worst* material to use," in contrast to the previously universal belief that "gold is the best material with which to save teeth." I cannot go into a discussion of the new departure. Suffice to say that its promulgation was followed by a great increase of the use of amalgam, guttapercha, and the phosphate cements. A very large number, possibly nearly all of the men who made good gold operations, could not be persuaded to accept the new departure creed because it was contrary to their experience and observation of their own operations. Unfortunately, there was at that time a very large number of men who either had never learned, or were always in too great a hurry, to make good gold operations, and these men were ready to accept the new departure creed because it did pretty well correspond with their experiences and observation of their own operations and those of other men like them. It may be said in passing that it was a physical impossibility, with any of the amalgam alloys in use at that time, to make a good filling in the sense that a properly made gold filling is good. Gold is an exacting material and cannot be trifled with if probable failure is to be avoided.

Everybody understands that soft foil must be wedged against the walls, either with wedge pointed pluggers in occlusal cavities or by the impact of the mallet in the cervical portion of proximoclusal cavities. Cohesive gold also should be so managed as to be wedged or driven against the cavity wall in a way to put the elastic dentin under positive and permanent tension. This gives the cavity walls a positive grasp on the filling to hold it, and what is possibly more important, the elastic dentin under tension will follow and retain close contact in the greatest amount of shrinkage that can happen to the largest filling under the greatest cold that can come upon it in the mouth Charles E. Woodbury, in a paper read, I believe, in Pittsburgh, and published in the *Cosmos* in 1912, states it in this way. "The walls being approached from thick masses of gold and the gold flowed against them and wedged by the line of force and accurate stepping, the elastic dentin of the tooth is compressed and forever hugs the filling with a grip that cannot be broken." Dr. Woodbury concluded his paper in these words. "I would emphasize the fact that there is nothing about the manipulation of gold foil that cannot be acquired by anyone whose natural gifts fit him for the practice of dentistry. To be successful all that is required is the very careful following of a certain technic in all of its details. Any short-cuts or compromises are almost always followed by failures."

No standard general rules can be laid down for the places where gold fillings should be made and where inlays should be made, because the personal equation

is of much importance in the determination. The man who makes gold fillings as they ought to be made may wisely make a great many foil fillings in places where inlays might be made. The man who cannot or will not make *good* gold fillings (I fear there must be a lamentably large number of such), should make inlays wherever they can be used reasonably, or else use amalgam. Nobody has ever claimed that the best possible inlay is any better than the best possible gold foil filling, but a poor gold inlay is better than a poor gold filling, for the latter is likely to prove practically useless, and in many cases the tooth will be no better than if it had been left alone entirely. A tooth with a poor gold inlay will be preserved for a time by the phosphate cement under it and it may fall out and require a new operation while the cement still protects it from penetration toward the pulp. While this is happening to the tooth with the poor inlay the one with the poor gold filling may be half destroyed and the pulp exposed by caries before the poor filling will fall out. There are two classes of cases, however, in which there ought to be almost universal agreement, on the one hand for the use of inlays, and on the other for foil fillings. For large restorations in which the alternative to an inlay ought to be an amalgam filling or a crown, no one would now make a foil filling. At the other extreme are the defective fissure and pits in molars and bicuspids, often in the incisors also. These should always be filled before decay begins or when small in amount, and they should always be filled with gold foil except for children so young that permanent operations are impossible or unwise, in which case black oxyphosphate of copper or tin should be used until gold operations can be made. Any man who cannot make good gold foil fillings in these places ought to learn how or cease practicing, for nothing else is suitable for them. They are often filled with amalgam, but in my opinion they ought not to be, and I have often had to refill such that might have been filled with gold permanently.

The esthetic reasons for the use of the silicate cements in the front teeth are very influential, but some small fillings in these teeth, if enough separation is obtained, can be made so as not to disfigure the teeth, and, if taken care of by the patient afterward, will last indefinitely. Also if the filling covers the contact point, gold will maintain the teeth in normal positions, while the silicate cement will wear too rapidly. Every man in practice and every student in the schools should make strenuous efforts, if necessary, (a few men seem to do it easily) to acquire and maintain the skill to make first-rate gold foil operations, and should be rewarded for it by receiving better fees for gold foil fillings, for the same time consumed, than for any other of the ordinary routine operations of practice.

Ten years ago an editorial in the *Items of Interest* announced "The Passing of the Gold Foil Filling," and there was great danger that the gold inlay and the silicate cements might wholly displace gold foil. If that were to happen, it would result, in my opinion, in lowering the standards of operative skill and diminishing the usefulness of the profession. It is very gratifying, therefore, to note the increasing interest in the old-fashioned gold foil operations. At the same time, the danger of too great a displacement of gold foil is still great enough to make it desirable that all men who can make good foil operations will do so, and *talk about it*, but especially is it necessary that all of the schools continue the full measure of instruction in the use of gold foil and increase rather than diminish the number of such operations required of students.

Bibliography

1. Guerini, *History of Dentistry*, p. 164.
2. Ibid. p. 159.
3. Ibid. p. 207.
4. Ibid. pp. 251-252.
5. Ibid. pp. 255-256.
6. Ibid. p. 259.
7. Ibid. p. 285.

8. "*Resolved*, that to Dr. Arthur, and to him alone, the dental profession is under obligation, for his liberality in laying before the profession the principle of using and welding together annealed gold, by the use of serrated pointed instruments, and that this Society desires to express its thanks to him for this, one of the real improvements in the mode of operating."

Discussion

W. R. Clack, Mason City, Iowa: The G. V. Black Club of St. Paul used different terms in speaking of the different preparations of gold foil than those which had previously been used. For our operations we used almost exclusively a gold called soft foil No. 4. This foil came to us in books, each leaf containing four grains of gold. I have always kept this foil in a drawer containing a chunk of ammonia, the fumes from which rendered the gold noncohesive. For cavities in the proximoclusal surfaces of the teeth, we used the gold in cylinders which were not annealed.

These cylinders were placed one against the lingual wall, one against the buccal wall, and the third, acting as a key, was driven to the gingival, the object being to have the unannealed gold line those three cavity margins, because of its greater adaptability. Then we went on with the same foil annealed to make it cohesive.

As Dr. Noyes says, this foil was driven, or condensed, in the direction of the cavity margin. Beginning at the center, the successive steps of the plugger were toward the cavity margin, the last steps tying the gold securely against that margin. If you wish water-tight margins, gold must be condensed in that way. If you begin at the margin and condense the gold toward the center, you draw the gold away from the margin. You can better illustrate this by going to a blacksmith shop and getting a piece of strap iron and a hammer. Lay the iron flat on the anvil, and beginning at the outer end with a succession of blows, coming back toward your hand, you may strike the iron ever so squarely—it makes no difference—it will begin to curl up from the end. Then reverse this order, striking from your hand toward the outer end, and the iron will lie down again, clinging to the anvil more closely at the end than anywhere else. It is just this way with foil. Many a gold filling was a failure from the start, because of this faulty manipulation. I have no doubt that the ancients understood many of these laws concerning the handling of gold. The man who does not understand it is the one who did not pay strict attention to the instruction given him.

The elasticity of dentin did not seem to be understood by the profession until a few years ago. The followers of Black's cavity preparation were so severely criticised "for their ruthless destruction of tooth structure" that we thought to make our cavity preparation without the pits, grooves, or undercuts that weaken a tooth. We found that the elasticity of the dentin was so great that if the gold were sufficiently condensed against it, it would retain that gold notwithstanding the stress of mastication. Because of the nonelasticity of the enamel, the diameter of the filling was greater at the dentin than at the enamel margin.

I remember giving a clinic on this point, March 7, 1911, at an alumni meeting of one of our Western dental universities. I was to make a gold filling in the mesioclusal surface of an upper first bicuspid.

I was to prepare a cavity that could be used either for an inlay or a gold foil filling. When I had my cavity prepared, ready for the filling, I called the member of the dental faculty before whom the test was to be made, and asked him to examine the cavity and say which I should make, an inlay or a gold filling, without changing the cavity. He examined the cavity very carefully and said to the boys around the chair. "A wax inlay can be drawn from that cavity without distortion, but I very much doubt the doctor's being able to make a foil filling that will remain in the cavity."

When I had placed my three cylinders in the gingival third of the cavity and had condensed them ready for the annealed gold, I handed the professor my plugger and asked him, without tearing the unannealed gold to pieces, to dislodge the gold from the cavity. He worked for a moment or two, and then turned to the audience, saying, "I can dislodge that by tearing it to pieces, but it sticks there as though it were glued." I said, "You have forgotten the elasticity of the dentin. It is that which hugs the gold so tightly." He immediately changed his opinion and explained to the boys what they had overlooked. He has ever since believed in the theory.

Dr. Woodbury expressed the situation in better terms than I can, when he said, "The

walls being approached from the thick masses of gold, and wedged by the line of force and accurate stepping, the elastic dentin of the tooth is compressed and forever hugs the filling with a grip that cannot be broken." I still quote from Dr. Woodbury, in his closing remarks, "I would emphasize the fact that there is nothing about the manipulation of gold foil that cannot be acquired by anyone whose natural gifts fit him for the practice of dentistry. To be successful, all that is required is the very careful following of a certain technic in all of its details. Any short cuts or compromises are always followed by failures."

I have no quarrel with inlays, alloys or silicates. I use them all and could not, in my opinion, practice dentistry honestly without them, but when conditions favor making foil fillings, I do not believe that the hand of man can make anything better than the gold foil filling. I passed through the craze of the new departure creed, and found there were places for the alloy filling, and the "inlay craze" shows us that there are places where a properly placed inlay will be far preferable to a gold crown. The inlay came at a time when the gold foil filling had reached a higher plane than ever before, and there were many who would not or could not make a gold foil filling that would come up to the standard. They hailed with joy a method that would release them from the strenuous work of the foil filling. They could make a cavity preparation that involved a sacrifice of more tooth structure than the G. V. Black followers made for their foil fillings. When they had made the wax pattern, they could sit with their feet on the laboratory table and smoke, while "the girl" invested, burned out and cast the inlay. They made the same class of inlays that they formerly made of foil fillings. You've seen some of those inlays that were not a "likeness of anything that is in heavens above, or that is in the earth beneath, or that is in the waters under the earth."

But there were many honest, skillful men who have brought the inlay to its present high standard where it saves many teeth that would otherwise be lost. Just where the line should be drawn is the question. There are many teeth which may be saved for a time with either method. Size of the restoration is not necessarily the criterion; I think the largest restoration I ever made was made with gold foil. March 21, 1905, I made a restoration in an upper left first molar which took twenty and one-fourth sheets of No. 4 foil—81 grains. The tooth is still in a healthy condition and the filling is apparently as good as when made. I would today, I think, use an inlay in such a case, but at that time I had very slight knowledge of gold inlays and no confidence in them, but it shows what can be done if rightly done.

Gold foil fillings should not be made for children before the periodontal membrane is sufficiently developed to withstand the force of the blows of the mallet. Such a course would result in injury to the tissues and insufficient condensation of the gold; the gold would pit, and failure at the margins would occur.

One good thing about gold foil fillings is that the rubber dam must be used. I know men in the practice of dentistry who have neither gold foil nor rubber dams in their offices. Is it any wonder that dental operations made after such methods fail? The men of the G. V. Black Club of St. Paul believe that after a margin is planed, nothing wet should touch it until the filling is finished. Rarely do I remove the rubber dam when making an inlay until the inlay is set. If anything makes it necessary to remove the rubber dam after the cavity is prepared for a gold foil filling, I always replane the margins before beginning the placing of the gold.

Willis A. Coston, Topeka, Kansas: While I think that Dr. Noyes' paper was very interesting in its historical recitation and probably told a good many of us things we did not know about gold foil, I am interested particularly in one phase of the question, and that is the decadence of the gold foil operation. I think in some regions of our country, as Dr. Black has said, gold foil is practically unknown. It has been replaced by gold inlays and by the silicate cements almost exclusively, and it seems to me too bad that this should be true. We know by experience and by history that gold foil fillings will maintain their position and preserve the teeth for half a lifetime.

I do not know just why men have given it up, unless on account of the work attendant in placing gold foil fillings. It probably takes a little longer, but in my experience and the experience of many men whom I know, the placing of gold foil fillings in those cavities in which it is indicated takes no more time than it does to make a gold inlay, and I think it is a much better operation.

I heard of a man once who was asked if he used gold inlays, and he said he did. They asked him how he used them. He said he used them exclusively. He was asked how he put the gold inlays in the small fissure cavities in bicuspids and molars, especially in children, and he said: "I cut them out until they are big enough to put an inlay in them." I

think that is a very sad commentary on the practice of dentistry if it is indulged in to any degree. If that is true, and if we cut out cavities until they are large enough to make it convenient to put in an inlay, then we have cut out tons of good healthy dentin and enamel in order to make it convenient for us to make fillings. I think it is our duty and our function to restore the teeth, to put in the fillings, and sometimes to put them in even if it be a little difficult rather than to cut out teeth until there is a convenient place to put in an inlay. We should have enough ability to put in gold fillings without having to destroy or cut the very heart out of the tooth. We hear a great deal of talk about esthetics or the lack of esthetics in gold restorations where they are visible. I think that is very largely overdrawn. When a patient comes to us with decayed teeth, the damage is already done, and we have to restore it in some way. We have the choice of putting something in there that will preserve the teeth and that will preserve the contact point for many years, or of putting in something of a temporary nature. I would very much prefer in my own case that a little gold should show and that my teeth would be preserved than to have them filled up with cement that will last only a very short time. To be sure, in the front teeth the most excellent restoration may be made with porcelain inlays, but it requires a great deal of skill and a great deal of time and probably the destruction of more good tooth tissue to prepare the cavity for a porcelain inlay than it does for a gold filling.

H. L. Ambler, Cleveland, Ohio: Martin, in his wonderful book on Egypt, says: "Mexico, Java and Ceylon were inhabited by extinct races, older than the Egyptians." Thousands of years ago they made gold leaf in Egypt, and I have a specimen to prove it, which I brought from Cairo, in the form of a miniature jackal covered with gold leaf; the jackal represents Tuamauotef, one of four sons of Horus who saved the dead from hunger and thirst, and so great numbers of them were placed in Egyptian tombs. They made gold into foil, because Maspero, in his book on Egypt, says: "Sheets of gold to cover obelisks and other objects were forged from pieces of gold on an anvil with a hammer; small objects were covered with small pieces of gold beaten flat between two pieces of parchment." I saw a picture of an Egyptian melting gold in a crucible, with a mouth blowpipe. It is possible that when King Tut's tomb is completely explored, gold fillings may be found. The Louvre contains a goldsmith's book, and the gold leaf contained is as pure as that used in Germany in the eighteenth century for gilding wooden statues and other articles. Now, by the process of electrolysis, gold leaf down to 1/4,000,000 of an inch in thickness can be made. In historical data, when gold leaf is referred to, as a filling for teeth, we take it for granted that it was gold foil, because, as we understand it, gold leaf could not be used as a filling, as it is very much too thin. The Romans used gold leaf for ornamenting their houses and objects of art by pounding the gold out so that it covered six hundred times its original surface. At the beginning of the Christian era, Celsus, a celebrated Roman physician, gave instructions for dental operations, such as extracting, scraping, filling with gold foil and fixing loose teeth with gold wire. Cicero says: "If the teeth are bound with gold, then that gold may be buried or burnt with the corpse." Twenty-three hundred years ago the Etruscans made four gold crowns, two of which covered natural teeth, and the other two were used as a bridge between them; they also filled teeth, but I am not sure they used gold foil. During excavations at Pompeii, dental instruments in use before 79 A.D. were found, and pictures on the walls represent different phases of dentistry, but in the museum there and at Naples, we did not see any gold fillings. Who can say, however, that they will not be found, as recently excavations have been started. Joannes Arculanus, about 1450, described filling teeth with gold foil and says: "The Arabians used it hundreds of years before." In July, 1630, the Plymouth colonists from England named the spot where they landed, Boston; with them was Robert Morley, a dentist, whom they engaged for three years, but the record does not show that he used gold foil; anyhow, he was *our first* dentist. Fauchard of France, in 1728, mentions gold foil for filling teeth. Woofendale came here from England in 1766 and brought gold foil with him. Greenwood came from England in 1770 and probably used gold foil. Gardette came from France in 1778 and he used gold foil, which he made from Dutch ducats, and in the same year Hunter of England said gold was the best filling material. Whitlock came from England in 1784, and probably used gold foil. Flagg of Boston, 1785: "mounts teeth with foil or gold." No doubt this means he filled teeth with gold. Hayden of Baltimore used gold foil in 1804; Waite of England before 1815, and Snell of England in 1832. Dr. Clute, Louisville, Kentucky, used *cohesive* foil in 1839; Dr. Westcott, Syracuse, New York, in 1840; Dr. Arthur, Baltimore, in

1855; hollow fillings can be made from this kind of foil by filling the bottom and sides of a cavity, then roofing over the top by building from the margins toward the center, where the filling is completed. Early manufacturers of noncohesive foil in the United States were Marcus Bull, Hartford, Connecticut, 1812; William Johnson, 1828; James Leslie, Cincinnati, 1838; Charles Abbey, Philadelphia, 1839; J. H. Ashmead, 1839; Ashmead and Hurlbut, 1846, E. Hurlbut and Co., 1864, and J. M. Weyand Company, 1866. A manufacturer of *cohesive* foil was James Leslie, Cincinnati, 1839, who proved that dentists in Louisville and Cincinnati used it, and I have the documents in my possession to show that he was right. Watts foil, 1860, perhaps earlier, was cohesive just as it was taken from the book, without further annealing. His No. 2 foil was popular for many years and so was No. 4, which was about one sixteenth thousandth of an inch in thickness. We have had plain, corrugated, frosted, noncohesive, semicohesive, adhesive and cohesive foil; cylinders, mats, blocks, ribbons, tapes, pellets and ropes. In 1838 Maynard of Washington used No. 12-30, and in 1850 Arthur used No. 30, which was probably made by the "beating process," because in 1859 that process was used, but the rolling process superseded it; the ingot from which it was made was alternately annealed and rolled. I know that, in 1870, No. 20-240 was made this way. Foil has been annealed by the dentist, with a gas or alcohol flame, but in 1895 Dr. Custer proved that the electric annealer was the best, and other noted dentists agreed with him. Whole sheets of foil, long ago, were annealed by placing them on very fine wire gauze, which was passed over an alcohol flame. Dr. Coates used a platinum pan just large enough to hold one sheet of foil, and covered it with 1 gill of clean rain water mixed with 40 drops of sulphuric acid, and then boiled it for a few minutes over a spirit lamp; after removing from the pan it would dry and be ready for use in a minute. This treatment removed all foreign matter from the surface and made it thoroughly cohesive. A plate of mica, or platinum, held over an alcohol flame, makes a good annealer. A flame for annealing must not contain chlorin, sulphur or phosphorus. R. Arthur of Baltimore used adhesive (cohesive) foil in 1855, and in 1857 he wrote a book entitled "A Treatise on the Use of Adhesive Gold Foil," published by Jones, White and McCurdy, Philadelphia, but we have not found any record of his having manufactured foil.

In 1851, about 6,600 ounces of gold foil were used in the United States, and at present about $3,000,000 worth of gold is used by dentists in the United States and about $100,000 worth of gold foil is buried yearly in the teeth of the dead. The world's product of gold for 1894, if beaten into leaf, would cover fifty-five square miles. Gold foil will float on water, although it is nineteen times heavier. For a time, foil in books was untrimmed. Gold, on account of its color and other good qualities, is the least objectionable for filling teeth of any one of the metals. A book entitled "Gold Foil" was written by J. G. Holland, whose nom de plume was Timothy Titcomb, published by Charles Scribner's Sons, New York. 1882. A book entitled "The Golden Tooth," by J. Maclaren Cobban, was published by F. N. Buckles and Company, New York. 1901.

CASE HISTORIES

By GEORGE S. MONSON, D.M.D., St. Paul, Minnesota

(Read before the American Dental Association, Cleveland, Ohio, September 10-14, 1923)

THE subject "history of cases," if not carefully handled, is apt to be merely a description of a series of successful operations which will add nothing of value to our work. History is looking backward, and there is too much tendency in this direction. It seems logical to me to consider the history of cases from the standpoint of failure as well as success, that we may learn how success develops from a recognition of the reasons for the failure. To look backward and observe our failures with a determination to profit by them will form a milestone on the road to betterment and a basis for logical changes in our mode of procedure. Changes in our work as well as in all other lines of human endeavor must be a natural and gradual process of evolution. No change comes about independently. It must be built up from the surrounding material and must have harmonious circumstances and scientific foundation, or it will not live. The cases enumerated in this paper were failures with the first restorations, and are used here because these failures pointed the way to some of the changes which we have injected into our work. My first experience in dentistry was in general practice, and we had and still have a great deal of detail technic in fillings and crown and bridge operations—all of which is beautiful when considered individually, but has no coordinate relationship with the entire masticating mechanism, and, when placed in the patients' mouths, made cripples of them. This was not, of course, done intentionally, but was the best we knew at that time. However, I am sorry to state that there are advocates and adherents to this kind of practice who still exist.

There is little excuse for a man not knowing how to make a filling operation or the detail technic of the construction of artificial dentures and bridgework. These subjects occupy an important position in the curriculum of all dental colleges, which also teach anatomy, physiology and pathology, but these subjects are not sufficiently correlated with the operative procedure. The knowledge of these basic subjects should be applied in our reconstruction work in such a manner as to restore the correct anatomic relationships, permitting the physiologic action to be as near normal as possible, and to render the patient the real service that is our duty. All of our graduates have received excellent courses in anatomy and physiology. Likewise, they have received careful instruction in detail technic, but, owing to a lack of practical application of the basic sciences, they make little use of them after graduation. This method of teaching is probably due to the fact that all, or nearly all, of the research and teaching

of the basic sciences is done in the medical departments of our colleges and by medical teachers, resulting in a distinct separation of the two lines of study. In other words, the fundamental subjects are not given sufficient consideration in relation to the mechanical detail of all types of reconstruction. We study the casts of natural teeth in central occlusion, but little attention is given to the relation of the teeth to the physiologic actions and anatomy of the adjacent structures. The position of the mandible and its normal excursions in mastication are dependent, to a great extent, on the length, position and form of the teeth. Also, there are several important structures contingent on the mandible for their normal position and physiologic action. The tongue, muscles of mastication, and throat structures cannot function properly if forced to accommodate themselves to an incorrect position by faulty relationship of the mandible to the maxilla. If regional anatomy is considered in the establishment of the length of tooth and position of the osseous framework, the result of the operation will be more successful. If we put in work that is of beautiful finish and detail without consideration of the mechanism of which it forms a part, the work will be a failure.

I shall now take up five cases illustrating the value of a correct diagnosis based on these fundamental principles. These cases are not confined to correction with full artificial dentures, as the same conditions may exist where the natural teeth are present, and were selected from different men's practices, to cover a wide range of disorders.

CASE 1. *Impairment of hearing and chronic throat irritation due to closed bite condition.* Mrs. M. T. L., aged 59, presented December 4, 1922, by L. L. Eckman, St. Paul, had worn artificial dentures for about thirty years, during which period several sets had been worn. There was intrusion of the condyles on the anterior wall of the external auditory meatus. Test for hearing showed: right ear, plus ¾ inch; left ear, plus ¼ inch. A constant clearing of the throat was observed during conversation, and the patient complained of having had throat trouble for years from which no relief could be obtained through local treatment. The bite was opened 10 mm. over the dimensions of the old dentures, but this did not relieve the condyle intrusion and was still short in dimensions; however, we felt that it was about all the patient could master in one treatment. The mandible was also advanced arbitrarily 7 mm. and the teeth set up in this relation. The new dentures were inserted, December 18, and, one week later, the occlusion was partially adjusted to allow a greater freedom in range. The patient was of the opinion that perhaps this change in dimension was excessive and more than she would be able to accommodate herself to; but after this first grind in, which gave her a free range of occlusion, she was able to continue with more comfort.

After a necessary absence of several months, the patient was seen again, Feb. 21, 1923, and voluntarily suggested that her throat irritation was materially relieved and her hearing very much improved. She had accommodated entirely to the change in dimensions and regretted that she had not tried a still further opening. She assured us that in the near future she would desire an additional correction. On examination, we found that, while we advanced the mandible 7 mm. by the set-up of the teeth with no overbite, we now had an overbite and the overjet was entirely taken up, so that it was necessary to regrind again to enable her to use an

end-to-end bite as the mandible came forward.

CASE 2. *Impaired hearing and a general malrelation of the structures of the oral cavity and throat.* Mrs. D., aged 65, who came to me for treatment in May, 1923, had lost her natural teeth at the age of 18, and had been using artificial dentures since that time. These dentures did not give the space or room in the oral cavity that the natural teeth did. There was a marked intrusion of the condyles in the auditory canals and a partial deafness. The pillars of the fauces, both anterior and posterior, were crowded posteriorly, incrypting the tonsils, and leaving but little of the glands exposed. There was a history of chronic throat inflammation which had endured since the loss of the natural teeth. The patient could not lie down without choking; this condition was diagnosed as being due to a crowding back of the tongue, similar to swallowing the tongue during anesthesia.

It was decided that it would be too great an inconvenience to the patient to open the bite to the extent of the position of the mandible with the natural teeth. A compromise was therefore made, and the dimension was increased 11 mm. more than the length of the old dentures. The balance of the restoration is to be made at a future time. It was found that, in addition to the forward position taken by the condyles in the fossa when the mandible was opened 11 mm., a better rest position was obtained by advancing the mandible 6 mm. This advance was made on the mandibular instrument and checked in the mouth of the patient.

As a result of this treatment the hearing has very much improved in this short time, and there is a marked general relaxation. The patient is not now under the nerve tension that is so common with patients in this condition.

Fig. 1a.—Side view of patient in Case 1 as she appeared in December, 1922, and in February, 1923.

Fig. 1b.—Front view of same patient.

The pillars of the fauces have assumed a more normal perpendicular relation and are no longer forced back by a posterior position of the tongue. The tongue, having more space between the palate and floor of the mouth, has moved anteriorly into the vault of the mouth when at rest. The tonsils, being no longer incrypted because of lack of space, have allowed the posterior pillars to move anteriorly and give a free drainage of the eustachian tubes during deglutition.

The inflammation and choking in the throat wholly disappeared in one month after the oral cavity dimensions were in-

creased. It is my desire to be able to make and maintain a complete restoration of the space for the tongue and adjacent organs as it was developed with the natural teeth. This can be done by replacing the length of tooth and alveolar process that has been lost.

CASE 3. *Reflex pain in the mental canal due to the impingement of the condyle on the auriculotemporal nerve.* A woman, aged 27, complained of an extreme pain in the region of the left mental canal.

Fig. 2a.—Side view of patient in Case 2 when seen in May, 1923, and a short time later.

Fig. 2b.—Front view of same patient.

It was thought by her physician and dentist that it was caused by focal infection from the teeth. This proved to be not the case, as all the natural teeth were removed and the pain still continued, but with more severity. In time artificial dentures were placed in the mouth and the pain was somewhat relieved, but in a short time it again increased, and she was referred to me by her dentist. The region on the lower denture over the mental canal was cut away, but without result. As the patient was quite desirous of having new dentures made, which she felt would give relief from her pain, I consented to make them, not with much confidence that I could relieve her. While I was making the restoration of area that is occupied by the tongue, I placed in the mouth the occlusal rims on the base plate, and inserted my little fingers into the ears, pressing anteriorly toward the condyles; I instructed the patient to open and close her jaws. The occlusal rims proved to be too short and allowed the mandible to close too far. In doing so, a branch of a nerve was felt in the left auditory canal between the finger and the condyle. The patient immediately placed her hand to her face over the mental canal and informed me that the pain was intense. The occlusal rims were then built up to a point where the condyle could not recede to a point that would pinch this nerve, and there was no more reflex. The dentures, when finished, gave her a considerable overjet, which would permit her a correct range of occlusion.

CASE 4. *Chronic throat inflammation due to faulty development of the os-*

seous structures; correction on natural teeth. Mrs. S. N., aged 28, was presented, September 28, 1922, by Dr. C. K. Bird of St. Paul, Minnesota.

On examination, the upper right first and second bicuspids and upper left second molar were found non-vital and infected. There was a chronic pyorrhea condition, the result of traumatic occlusion; developed prognathism, the result of lack of development, due to early loss of the four six-year molars; right lateral shifting of the mandible from excessive function on the right side, and a chronic tonsil and catarrhal condition due to closure of the bite and the im-

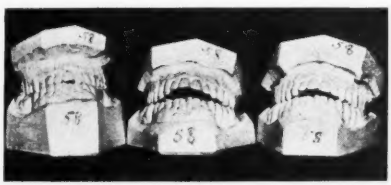

Fig. 3.—Casts made of Case 4.

paired function of swallowing, the profile concave and nostrils being almost closed.

Casts of the case were mounted on the mandibulo-maxillary instrument with the aid of the transfer bow and check bites; the bite was opened 5 mm. and, by the use of the "positioning guide," the amount of immediate retrusion was ascertained. With the balanced occlusion guides, a concentric arc was established in the amount the bite was opened and, by the use of these guides, a balanced occlusion in the molar region was obtained with fixed reconstruction. The bicuspids and anterior teeth, immediately after reconstruction was completed, were from 1 to 5 mm. apart.

Eight months later, casts (Fig. 3) were made showing all the bicuspids in occlusal contact and the anterior opening reduced over one-half. The patient stated that she had passed the first winter in years with no tonsillitis or catarrhal trouble. The mucous membrane was pink and healthy, and there was no periodontal inflammation. The profile was straight, the nostrils were open to normal, and the general physical condition was greatly improved.

Case 5. *Irritation of the apex of the tongue due to lack of area in the oral cavity.* W. G. B., a man, aged 40, presented, October, 1921, by Dr. H. B. Washburn, had an inflammation on the apex of the tongue, small in area but decidedly sore, which had been present continuously for a period of about two years. By questioning the patient, it was learned that this soreness became a great deal more acute at times of particular mental and physical stress, when time was limited too greatly for meals and sleep. This tongue condition had developed a keen sense of worry in the patient, as he could easily imagine cancer of the tongue. Various types of treatment by competent physicians had been administered, with no beneficial results.

Examination of the dental area revealed the following points for diagnosis:

1. All the teeth were present except the upper right first molar, the upper left first molar and the lower right second bicuspid. As a result of the loss of these teeth early in life, the mandible and, along with it, the maxilla developed asymetrically, one side 5 mm. from the distal of the third molar to the mesial of the cuspid more than the other side.

2. Both the upper and lower arches were insufficiently developed laterally, a condition which produced in the lower arch a decided crowding and irregularity of the six anterior teeth, the left central and right lateral being crowded back about 2½ mm. It was the patient's belief

that this irregularity was the cause of his sore tongue, and his remedy was placing paraffin wax on the lingual of the six lower anteriors, a treatment that produced for him a smoother contact for his tongue. It was his desire to extract the two teeth standing the farthest lingually.

3. Obviously, the constant presence of the wax meant a lack of mouth hygiene. The resultant increase in bacterial growth assisted materially in making an already sore tongue worse.

4. Further examination revealed a lack of vertical development of the lower bicuspids and molars, resulting in an abnormal overbite. This overbite acted as a restraining influence to any forward positions of the mandible, whether in lateral position or directly forward. This condition having prevailed for many years, there had come about a further closing of the bite due to abrasion, and the mandible was actually accommodating itself gradually to a new relationship distal to its original position. Manifestly, this new position of the osseous structure carried with it all parts contingent thereon.

The points disclosed above having been carefully observed by the aid of questioning the patient, the use of roentgen rays and casts of the upper and lower arches correctly mounted, the case was diagnosed as follows: Due to the early loss of teeth, together with lack of development of the mandible and maxilla, and insufficient vertical development of the lower posterior teeth and subsequent abrasion of the teeth, there had resulted enough backward positioning of the mandible to decrease the area in which the tongue functioned. In addition, the excessive overbite prevented a normal forward movement of the mandible, which further restrained the tongue. The anterior irregularity and large number of bacteria from an unclean mouth aggravated the tongue condition still more.

Treatment consisted in first eliminating the paraffin wax and thoroughly polishing all the teeth, after which the bite was opened the full amount of the overbite, thereby allowing freedom of mandibular movements in any range. This was accomplished by constructing an interocclusal denture of gold upon the lower bicuspids and molars to a balanced occlusion. At the expiration of six months, the tongue disturbance disappeared and has not returned even slightly.

Six men in general practice were asked what was their guide as to the height of the occlusal rim in constructing full dentures. All six were in favor of the lip line. Does it seem reasonable to use a transitory tissue such as the lip to determine the relation of the mandible to the other structures of the head and neck? Where there has been a closed bite condition, either from short dentures or abraded natural teeth, the lips are shortened and thickened from pressure one against the other. The transitory tissue about the mouth is pushed out of position, and, as it takes from a month to six weeks for them to drape back, they *should not* be used as a guide for the length of tooth and position of the mandible.

Take the next six cases that come to you wherein there has not been any considerable closing up through abrasion or partial loss of the teeth and record the distance from the angle of the nose to the tip of the chin. Then when the occlusal rims have been built with the lip line as a guide, again take this measurement and compare it with the original dimension before extraction. Then try and visualize what the position of the lip line would be if the patient were allowed to go several years with dentures that were too short.

Discussion

William Denton Taylor, Newark, New Jersey: It is taken for granted by Dr. Monson that we are all familiar with the Monson principles of occlusion. We have learned from previous papers read before this organization:

1. The *correct* relation of the mandible to the maxilla.
2. The *correct* relation of the tissues adjacent to these structures. (This would include the tongue, floor of the mouth, the tonsils, the muscles of mastication and deglutition, etc.).
3. The manifestations of the *incorrect* relation of the two structures, which would include:
   a. Loss of dimension of the lower third of the face.
   b. Loss of tone or tension of all the muscles of mastication and expression, and all other muscles having their attachment on the mandible.
   c. Loss of drainage of submaxillary and sublingual glands, tonsils, eustachian tubes, and posterior nares.
   d. Impairment of function of these parts, and others, i.e., the throat and ear.

So, already understanding these points, we are offered today, for our consideration, the results obtainable and the benefits accruing from an intelligent carrying-out of these principles, not in Dr. Monson's hands alone, but in the hands of several familiar with the Monson theory. These results, then, become a substantiation of these principles—carefully worked out over a long period of years, very valuable and very interesting.

I would like to call your attention to the care used in these case histories. If we would view our cases with more of the thoroughness that is apparent in the cases cited, in an effort to learn all the impaired physiologic functions existing, instead of looking merely on the mechanical phase of our case—if, in other words, we would use our heads instead of just our fingers—we would more honestly serve.

True, in college we were taught anatomy, physiology and pathology to some purpose, all correlated and interdependent one on the other. Our judgment should dictate that if the anatomy of a part has been altered, the physiologic function of the part must likewise be altered. I might say that many present believe that the indications of anatomic and physiologic impairment are apparent mainly in edentulous cases. To be sure, the changes in the relation would probably be more rapid in this type of case, even though dentures were originally constructed to proper length, due to abrasion, representing lost dimension, or closing of the bite; and where two, three, four or more teeth have been lost, this closure must needs be accentuated. If, in our efforts to serve these people, we merely fill in these spaces, we cater to an improper relation, an abnormal condition, and so doing, invite more physiologic impairment. It would seem, then, to be the logical thing, the honorable thing to do, to build our appliances whether filling, bridge, or denture, in the way Dr. Monson suggested—to the ideal, natural relation.

The matter of using the lip line as a guide for denture construction is such a fallacy! "Transient tissue" it has been called, and very well chosen words they are. The lip becomes a guide to what? To the proper relation? No, to the appearance; to the eye only. We would sacrifice efficiency in our work to gain an effect which is more quickly pleasing to the eye. If we would but disregard the immediate effect and build our cases to the proper relation, most of us would marvel at the quickness with which the thickened, flabby "transient tissue" will adapt itself to the old original condition, and lengthen. The result, then, is truly pleasing—and lasting.

F. H. Skinner, Chicago, Illinois: There are many men who still advocate seating the condyles as far back in the glenoid fossae as the patient's jaw can be pushed, registering that point in which both condyles are completely seated in the posterior portion of the glenoid fossae, using the incisal path-marker to locate central occlusion. This is a very good procedure in some cases, and a point from which to start in others, in order to correct pathologic conditions of the glenoid fossae and of the throat and tonsillar region, and frequently to give sufficient tongue room for clear enunciation. It should then be determined how far to open the bite and advance the mandible in central occlusion, where indicated.

In some cases, Dr. Monson speaks of grinding in twice within a week's time. It has not been definitely proved, as yet, what changes take place in the glenoid fossae, after mandibular correction, and I do not suppose it will be until we have an opportunity to hold some postmortem examinations on cases which have been rectified and the mandible maintained in a correct position for a number of years.

Nature is very kind in her restorative work, but just what takes place, permitting us to make these radical changes in relation and still maintain or add to the comfort of our patients, is very much in dispute. In some cases, on the removal of interdental splints which have been worn on the posterior teeth for six months or a year, patients are unable to occlude the posterior teeth, indicating either a depressing of the teeth, increased angle of the mandible or a change in the glenoid fossae.

The results reported in this paper bring out very forcibly the necessity for preservation of

Fig. 1

the temporary teeth until the permanent teeth are in place, and especially the necessity for the preservation of the four first permanent molars, because, when any tooth is lost, full development and function of the alveolar process which supports the other teeth is to a greater or lesser degree restricted, thereby allowing the bite to close. This deficiency in development usually takes place in the region of the posterior teeth, the supporting tissues of the anterior teeth being already well developed. The abnormal overjet causes an undue pressure on the anterior teeth, frequently resulting in protrusion and injuring the mandibulo-maxillary articulation, and usually forcing the mandible posteriorly; or it produces trauma on the tissues supporting the anterior teeth, until pyorrhetic conditions develop and the teeth are lost.

The wear from attrition in the average person 40 years of age has also lessened the length of the bite, and instead of grinding off the high spots to bring the stress of mas-

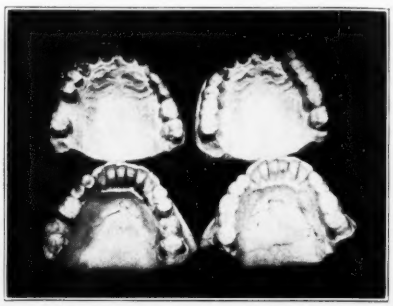

Fig. 2

tication parallel with the lines of normally balanced occlusion, it is my belief that sufficient restoration should be made on the posterior teeth to bring all the teeth in full occlusion when the mandible is thrown far enough forward to bring the anterior teeth to an end-to-end position. This, however, must be governed by the encroachment of the condyle upon the external auditory meatus, which is determined by the sense of feeling obtained by placing the little fingers in the patient's ears, bearing forward and downward and having him open and close his mouth. The right position, approximately, can be obtained by building up the modeling compound rims until the movement of the condyle can just be felt thus by the

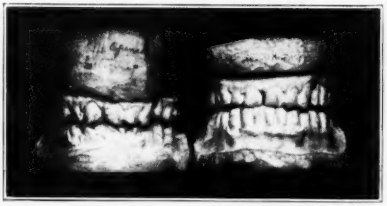

Fig. 3

little fingers. Modeling compound or gutta-percha biting splints are a great help in determining the correct amount to open the bite when working on natural teeth.

The accompanying illustrations show two

sets of models from my own practice. Figures 1, 2 and 3 show the immense overjet, the irritation of the gingival tissues around the lower anterior teeth and the fossettes worn on the lingual surfaces of the upper teeth. These restorations were made with individual inlays or crowns on each tooth and bridges where necessary, bringing the anterior teeth to an end-to-end occlusion. There was no deafness, but the patient, a priest, said that his associates immediately spoke of the great improvement in his enunciation. This was due probably to the increased space for tongue

Fig. 4

movement. He had been troubled a great deal by small particles of saliva flying from his mouth when conversing with people and in his addresses from the pulpit. This was entirely corrected. We opened the bite 8 mm., and advanced the mandible 5½ mm. There was some soreness in the glenoid fossae for about a week, but that entirely disappeared, and his general condition, as well as his facial appearance and ability to masticate food properly, was generally improved. All loose teeth became firm within a month's time.

The second case, shown in Figures 4, 5 and 6, had bridgework which was not in full occlusion. In fact, there were only three teeth in occlusion when the patient came to us. We had to discard all the bridges, make our diagnosis and do the building up according

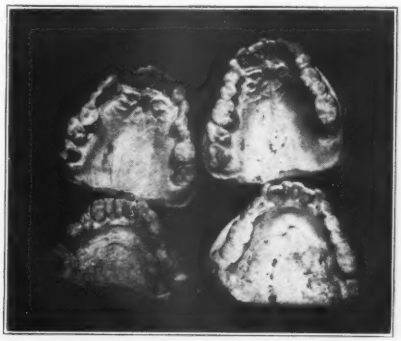

Fig. 5

to findings. The bite was opened 8½ mm., and advanced 5. The personal appearance, enunciation, chronic throat trouble and mastication were greatly improved; all loose teeth became firm, and the tissues assumed a normally healthy color.

Where artificial dentures are made up with both condyles seated as far back in the glenoid

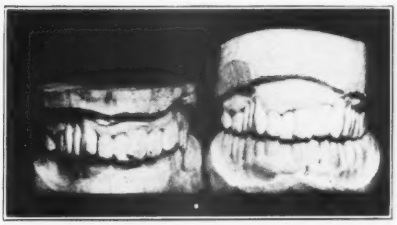

Fig. 6

fossae as possible, which has been and still is practiced, none of the pathologic condition that has been developing for years because of the loss of teeth, wearing off of surfaces, or lack of development of the alveolar process is rectified unless the correction is made as indicated by the Monson principles.

DIET AND ITS RELATION TO THE PREVENTION OF DENTAL CARIES

By RUSSELL W. BUNTING, D.D.Sc., Ann Arbor, Michigan

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THE announcement of a new discovery is usually a source of disturbance, uncertainty and readjustment. Most new findings are more or less at variance with our preconceived ideas. If it were not so, the findings would not be new. Immediately following the announcement of a new discovery, there is a period of examination and of careful weighing of the findings in relation to formerly accepted opinion. If the new theory can be supported fully by facts and by sound reasoning, the old must either conform to the new or must be thrown into the discard. On the other hand, if the older theory, in the light of the newer findings, may still be substantiated, the new theory must be made to conform to the old or it will fall.

Today we are in the throes of such a period of examination following the announcement that various deficiency diets produce changes in the structure and health of the teeth and in the periodontal tissues. The classic work of Mae Mellanby on rachitic dogs, of Percy Howe on scorbutic guinea-pigs and on monkeys, and of McCollum and Grieves on rachitic rats, in which profound changes were produced in the teeth and alveolar structures of the experimental animals, has aroused widespread interest. The discovery that caries-like and pyorrhea-like lesions may be produced in animals which normally are highly immune to these affections, by feeding deficient diets, has led many enthusiastic observers to the conclusion that caries and pyorrhea are largely, if not wholly, the result of faulty diet. Wherever this newer view fails to coincide with the older accepted theories, many would wholly discard the old and attribute dental disease to this newer concept of diet. Moreover, the proponents of this theory have gone as far as to assert that, given the adoption of an adequate diet, good tooth formation and freedom from dental disease may be assured.

Before accepting these newer views, we should carefully weigh the experimental data on which the theory is founded in the light of known facts. If the theory cannot successfully stand the test of such scrutiny, it must be modified or rejected.

The results of dietary experimentation have proved beyond question that marked developmental defects and disease stigmata may be produced in animals by depriving them of certain vitamin principles or by feeding them diets containing an improper balance of inorganic salts. But the question arises, "How far may these data obtained from animal experimentation be translated into terms of the human equation?" This is the question that always arises in the evaluation of any animal experimentation.

For instance, the guinea-pig experiments were largely confined to the feed-

ing of the vitamin C free diets, which in these animals produced scurvy. The rat, on a similar diet, will thrive, for he is seemingly immune to scorbutus. Here, then, is a radical difference of constitution and metabolism existing between two animals both of which belong to the *genus rodentia* and therefore are more closely related to each other than either would be to *genus homo.* Is it not reasonable to expect that there would be even greater differences of reaction between either of these animals and man than exist between each other? An illustration of this fact is seen in the different effect of fresh meat on the guinea-pig and on man. The feeding of fresh meat or of meat juices to a scorbutic guinea-pig does not relieve the symptoms; from this it has been inferred that there is no vitamin C in meat. But Steffannson, in the account of his polar expeditions, states that those of his men who had fresh meat did not suffer from scurvy as did those who did not have any. From this and other data, it is evident that fresh meat contains vitamin C sufficient to the bare requirements of man but wholly inadequate for the guinea-pig.

Mitchell[1], in a discussion of the relative value of animal experimentation, says, "The statement that a food is deficient in a certain vitamin defines a relation between the vitamin content of the food and vitamin requirement of the experimental animal, and hence cannot with any degree of certainty be applied to other animals. In many of the original articles reporting the results of feeding experiments relative to the distribution of vitamins in food materials, this loose interpretation may be found. As a result certain foods are generally classed as being deficient in certain vitamins. We are told that the cereals and many of their milling products, white potatoes, white breads, meats and animal fats are deficient in vitamin A; that white bread and milk are deficient in vitamin B, and that most dried and preserved foods are deficient in vitamin C, when the facts only warrant the statement that they are relatively poor in these vitamins. For all that is known to the contrary, the vitamin content of these foods may be considerable in relation to human requirement and hence in dietetics they cannot be considered deficient in them in any strict sense of the word."

The value of the guinea-pig for dietary experimentation is open to question from a number of angles. In the first place, the dietary requirements of this animal are restricted to rather narrow limits. For a long time it has subsisted on succulent vegetables, herbs and roots, and on these alone it can live well. In the use of such an animal for observation under various manipulations of diet, great confusion is bound to arise from the many idiosyncrasies and lack of food tolerance existing in the guinea-pig which are not so evident in the rat or dog. These latter animals have for ages been forced to adapt themselves to a wide dietary program and have established a tolerance for an omniverous diet. In this respect, the dog or the rat more closely resemble man in their dietary requirements and ability to utilize a wider variety of foods than does the guinea-pig. As Grieves[2] expresses it, "Such special (food) requirements in guinea-pigs make it next to impossible to compare this species with man or the rat in similar dietary studies. Experimental data obtained with guinea-pigs must be used with caution in conclusions as to the etiology of human scurvy, and we might add other dental and maxillary diseases."

Neither the rat nor the guinea-pig can develop properly or reproduce his kind on many forms of diet which in the human race may produce splendid physiques and strong, healthy offspring.

1. Mitchell, H. H.: Science, July 14, 1922, p. 34.

2. Grieves, C. J.: Journal of the American Dental Association, June, 1922.

It would appear, then, that each animal has his own dietary requirement and coefficient of food tolerance.

As far as the teeth are concerned, those of the guinea-pig are all of the continuous pulp variety, a form quite unlike the fixed teeth of man. It is easy to visualize how disturbances of diet might be registered in alterations of growth and subsequent structure of teeth which are constantly in the state of development, but similar conditions would not be obtained in the fixed type of tooth except in the developmental stage, and then only in a modified form. Since the molars of the dog and of the rat are of the fixed type, these animals constitute better experimental material from the dental standpoint.

It is also significant to note that, in all of the dietary experiments on guinea-pigs, scorbutic diets were fed which produced conditions simulating scurvy, a disease which has become almost unknown in this country except as it may occur among infants raised on boiled or preserved foods. Recognizable scurvy is confined almost solely to very young infants of the poorer classes. It is granted that many mild border-line cases exist but these, as well as the severe forms, disappear promptly when the child becomes old enough to adopt a varied diet. The experimental work, as far as it is related to the production of scorbutus, is interesting and exceedingly valuable and may explain many forms of tooth hypoplasia which occur during infancy, but the attempt to associate such a rare disease with such a common affection as caries or to establish it as an important factor in dental disease during childhood and adult years is little short of absurd. It is true that caries-like and pyorrhea-like lesions are produced in animals concomitant with scorbutic disturbances, but the nature of the dental lesions and the conditions under which they are produced are so far removed from what is characteristic in man that their significance is seriously open to question.

The work on rachitic rats is not subject to such serious objection. Acute and chronic forms of rickets are frequently observed among children of all ages, and, as we study these conditions more closely, we are impressed with the fact that there is a still larger number of border-line cases in which subacute or latent forms of rachitis exist and militate against normal development of the bones and the teeth. It is also apparent that, notwithstanding man's greater tolerance for food deficiency, many classes live in a border-line of undernutrition as expressed in rachitic tendencies, underdevelopment, and metabolic disturbances corresponding in a degree to the changes observed in the experimental rats. Thus it appears that for nutritional experiments as far as they are related to the teeth of the animal and of man, the rat, by reason of the similarity of his dietary requirements, his type of teeth, and the ease with which rachitic changes may be produced in him, constitutes a most valuable experimental animal.

Let us turn, then, for the moment, and consider the types of dental lesions produced by animal experimentation. Are they identical to those found in man? Do they follow the same laws of occurrence and do they run the same course?

As a result of feeding various deficiency diets, lesions occur in the teeth of experimental animals which in many respects resemble caries. There is a discoloration of the enamel, followed by dissolution and the formation of a cavity extending into the dentin somewhat like true caries. There are evidences of decalcification and, when the dentin is reached, bacteria may be demonstrated invading the tubuli as they do in human caries. There are, however, certain points of difference between experimental animal caries and true caries.

In the first place, animal caries is almost wholly confined to the sulci on

the occlusal surfaces of the teeth. Approximal caries, which is so characteristic in man, is conspicuous by its absence in animals. In studying these cases one is led to wonder, if this is true caries, why it does not appear in the approximal as well as the occlusal surfaces.

Moreover, the appearance of caries in these animals is usually accompanied by other pathologic changes such as resorptions on the pulpal wall of the dentin, resorptions of the roots of the teeth and of the alveolar processes, osteoporosis, and changes in the periodontal tissues similar to pyorrhea. Such a pathologic syndrome has no counterpart in man except under most unusual and severe metabolic disturbances. Pulpal resorptions in man are extremely rare occurrences, as also are resorptions of the roots of permanent teeth having vital pulps. It is also a matter of common observation that, in man, caries and pyorrhea are not usually active simultaneously. When caries is active, there is, as a rule, slight evidence of periodontal disturbance and pyorrhea; on the other hand, when pyorrhea is active, there is usually little dental caries. Exceptions to this rule may be found, but, as a general principle, it may be stated that caries and pyorrhea are two separate and distinct disease processes which do not tend to occur simultaneously. It follows, then, that dietary experiments which produce simultaneously both caries and pyorrhea as well as tooth and alveolar resorptions are outside the limits of human experience, and any conclusions drawn therefrom relative to human diet and nutrition are open to serious question. Not until certain forms of dietary deficiency or abnormality are found that definitely predispose the animal to either caries or to pyorrhea to the exclusion of the other may we feel confident that our experimental data are correlated to the problem of dental disease in man.

At this point I should like to make it clear that I would in no way minimize the value of animal experimentation or detract from the truths which have been revealed through them, but I do wish to sound a note of warning against the drawing of too hasty conclusions and the direct transference of animal experimentation into terms of the human equation, especially as they refer to dental disease. Because of the fact that guinea-pigs fed on a scorbutic diet develop dental caries, it by no means follows that Miller's theory of caries is erroneous nor that caries may be prevented by feeding a well-balanced diet. There are many factors other than the diet, important as it may be, which must be taken into account before we can arrive at any intelligent understanding of the problem.

Animal experimentation has thus far directed our attention to the importance of a proper balance between calcium, phosphorus and vitamin requirements especially in young and growing persons. The exact relationship or the proper proportion for man can not be determined from such animal experimentation and can be arrived at only by actually applying them to man, as Hindehede has done. It is claimed that the average American diet is very near the border-line of safety as far as these requirements are concerned. It is evident that man possesses a greater range of tolerance for dietary deficiency than do the animals, for if it were not so, there would be far more developmental disturbance and disease among the peoples of the world. Still, there are many indications that man, in spite of his greater tolerance, may suffer from a disproportionate calcium-phosphorus-vitamin balance. Until the time comes when we shall have more accurate information concerning the exact dietary requirements of man, it is rational to conclude that, at least during the formative period, the calcium, phosphorus, and vitamin bearing foods should be reasonably augmented to insure at least the minimum requirements for proper de-

velopment and the maintenance of health. Farther than this we can not go at the present time.

Sherman and his collaborators, in a report made to the New York Association for Improving the Condition of the Poor, made a study of the calcium and phosphorus content of the dietaries of 224 family groups distributed throughout the United States. Of these family groups, eight showed less than the normal phosphorus content, and two of these were diets from Southern states. In connection with calcium, one out of every six showed a calcium content below normal requirements. Hence they concluded that in the average American dietary there is little danger of a deficiency of phosphorus, but that many American dietaries are close to and often below the border-line in regard to the calcium content.

It must be remembered, however, that the adoption of an adequate or an ideal diet does not insure normal development or freedom from disease. It is obvious that normal osseous and dental development cannot take place if insufficient building materials, calcium and phosphorus and the vitamins, which seem to be associated with calcium metabolism, are not supplied. But all of these principles may be present in the diet adequate to the needs of the individual and still ossification and dentification will be impaired. The problem is a complicated one involving all the factors of digestion, absorption and the ability of the cells to utilize calcium and phosphorus in calcification. When we consider the calcium waste in digestion and all of the influences which may militate against its absorption, when we view even skeptically the possible influences of endocrines on calcium metabolism, and when we take into account all of the idiosyncratic reactions which the individual may possess by reason of a long line of hereditary transmission, it becomes very clear that diet is but one factor in the problem of nutrition. A well-balanced diet is *sine qua non* to proper bodily development and to the maintenance of health, but if those other factors of nutrition which are necessary to the proper utilization of food are not present, normal development and health cannot be attained. Take, for instance, the common example of two children in the same family, one of whom may have a fine physique, strong, well-formed bones and teeth, and freedom from dental caries, while the other may be undernourished and have poor teeth with active caries. In both cases the food and environment are practically identical, but the difference lies in the inherent qualities of the individual which determine the mode of his development and his susceptibility to disease. Food requirements, therefore, are a factor in the problem of nutrition, but the hope that normal development and freedom from disease may be attained in any large percentage of persons by diet alone is very slender indeed. Especially does this apply to the development of the teeth and to the prevention of caries and of pyorrhea.

Various surveys of the peoples of the world have been made in an attempt to correlate the national or tribal food and dietary habits with the development and health of the dental tissues. It has been found that the teeth of many races are unusually good and are notably free from dental caries. From a study of the diets of these peoples, a variety of conclusions have been drawn. Pickerill believed that acid foods were commonly characteristic to all dentally perfect races, while Sim Wallace held that hard and firm foods were most important. More recently, McCollum and his associates have attributed the splendid physiques and dental health of these peoples to the inclusion of the vitamins and adequate amounts of calcium and phosphorus in the diet.

Statistics and correlations of the diets of various peoples are interesting but may be misleading, for the food and the

dietary requirements of all peoples are not alike. "What is one man's meat is another man's poison." In fact, there may be as wide variation in food requirements and tolerance of various peoples as there is between man and the rat or the guinea-pig. It will be noted that the races which are uniformly physically fit and dentally perfect are those that live simple, natural lives and subsist on a very meager and often monotonous diet of foods common to the locality. The Chinese coolie, the Igorote, the Burmese and Siamese, the East Indian, the African and the native of South America, as long as he lives in his natural, native environment and eats the native foods, has splendid physical development and is practically free from dental disease. When any of these peoples migrate to the cities or are transplanted in another country with different food and different environment, they and their progeny may show the effects of physical deterioration, and dental disorders become prevalent.

In a recent study made at the University of Michigan of members of the Cosmopolitan Club, it was clearly apparent that, as far as the teeth are concerned, those who live in the cities of various foreign countries have dental defects but, in those same countries among the peasants and native farmers, dental caries and dental services are almost unknown. No uniformity or commonly prevailing principle could be discerned between the diets of the various caries-immune races in different parts of the world except that in each instance such people have lived on native foods which were common to their locality and which had been the sole dietary regimen for hundreds of generations.

This brings us to a consideration of the part played by heredity and evolutionary development of the race in its relation to food tolerance and dietary requirements. Practically all peoples who are notably physically sound and who are free from dental defects are indigenous to certain localities in which their ancestors have lived for thousands of years. Living as they have from earliest times on foods common to the locality, they have developed a high degree of tolerance and adapability to those particular foods. Through generations in which the laws of the survival of the physically fit and natural selection of the physically strong have prevailed, a race has been developed which has attained a maximum degree of physical perfection on the characteristic diet and under the environmental conditions which prevailed. In this manner, all idiosyncrasies against the habitual diet have been eliminated and the highest degree of tolerance and of adaptability has been attained. Thus, there has developed a race that is true to type and is quite unlike other races in its dietary requirements. When individuals or groups of this race intermarry with members of other races having different characteristics or when they change their diet or their environment, they or their progeny may manifest many idiosyncrasies against certain foods and an inability to utilize their diet for perfect development and freedom from disease.

Then, as we turn to the more civilized and less natural races, especially the Caucasians of Europe and of North America, we find that quite different conditions prevail. Here there are fewer of the pure racial types and more intermarriage between races, intermarriage of the physically unfit, and a survival of the weak instead of the strong. The diets of these peoples vary widely and are often very complex. There is no fixed dietary regimen to which the individual might adapt himself, but rather is there considerable variety from which he may choose according to his taste or his ability to procure. Here dental maldevelopment and disease is the rule rather than the exception, and the needs for dental service everywhere increase with civilization and with the complexity of life. It is interesting to note, in

this connection, that the peasants of Continental Europe who have adhered to the simple but adequate diet of their forefathers have, as a rule, well-formed teeth and are free from caries, but when they come to this country and adopt the varied American diet, they frequently develop dental disease and their children have inferior dental and maxillary formations.

In the United States we have no peasants. The American farmers do not adhere to a simple diet but have as wide a variety of foods and as faulty a dietary regimen as do the inhabitants of the cities. They also suffer from as much dental disease and defect as do the urban dwellers.

When we consider the ideal diet of the American people, we are forced to take into account not only the minimum requirements of proteins, carbohydrates, fats, inorganic salts, and vitamins, but also the differing types of people with their varying degrees of food tolerance and idiosyncrasies which they have inherited from their progenitors and which have been acquired by practice. In this country, "the melting pot of the world," where there has been so much intermingling and intermarriage of immigrant races, the people exhibit such a wide variety of characteristics that there is no true American type in the same sense as racial types exist in the Old World. So that for this complex and composite American race there can be no uniform or ideal dietary requirement. A diet that is ideal for one individual or group may be wholly inadequate for others.

It becomes evident, therefore, that in the study of the food requirements of the human race we must take into account the individual, his antecedents, and his present needs. For a complex race such as ours, no uniform nor all-embracing program can be made except in the general terms of minimum basal requirements. These requirements will vary with the age, the type, the physical condition, and the environment of the individual. We should recognize dietary and food requirements as very important factors in health and disease, but the attempt to establish any one food principle or group of principles to insure normal development and freedom from disease is not in accordance with known biologic principles.

As we consider the principles of the newer knowledge of nutrition as they relate to the cause and prevention of dental caries, we should always keep clearly in mind the known facts appertaining to that disease. To these facts all new theories must conform and by them may we rightly judge the verity of our newer postulates. It is profitable, then, at this time, to review the known facts concerning caries irrespective of the theories and the speculations thereto, in order that we may clarify our vision and avert the drawing of erroneous conclusions. It is true that, as we review them, the list of these established facts is not large, but meager as these facts are, they should serve to shape the trend of our thought toward the true solution of the problem.

In the first place, we know that the hardness or softness, i. e., the resistance, of the tooth enamel does not determine dental caries. It may be a factor but not a determining one. Instances without number are seen in which the hardest and structurally perfect enamel succumbs to the action of caries, while in other cases soft and poorly formed teeth remain throughout life without carious defect. I had occasion recently to examine the mouth of a child, aged 11, whose teeth, deciduous and permanent, were entirely devoid of enamel. These teeth, composed wholly of dentin without any protective enamel, had thus far passed through the usually susceptible period of early childhood without a single carious defect. Surely these teeth were low in resistance, and had that been the determining factor they long ago would have been destroyed. It

is true that when the conditions exist that favor caries, teeth having poorly formed and defective enamels will be destroyed more rapidly and more extensively than the perfect forms, but the controlling influence that determines the process of caries does not reside in the strength or resistance of the tooth.

The questions of faulty tooth development and the prevention of dental caries involve two separate and distinct processes: One has to do with the formation of the teeth and the quality of physical perfection which is attained previous to birth and during the early years of childhood; the other involves forces and conditions which become active only after the eruption of the teeth and after their exposure to the environmental conditions of the oral cavity. Therefore, in a study of diet and nutrition, as they relate to proper bodily development and physical well-being, it must be remembered that a diet which is conducive to good bone and tooth development is not necessarily unfavorable to caries. It is possible, then, that a diet may be adequate as far as the developmental and structural requirements of the body are concerned and at the same time be favorable to caries.

The next significant fact concerning caries is its location. If as some would have us believe, caries is an inherent disease of the tooth and arises from structural defects in the tooth and from changes in the blood supply of the pulp, it might reasonably be expected that caries would occur at any location on the tooth, since all portions of the tooth are subject to nutritional changes. This theory, however, does not harmonize with the facts. Caries is limited in its occurrence almost wholly to certain definite locations on the tooth, namely, pits and fissures of the occlusal surface, the approximal surfaces, and the gingival third of the buccal and labial surfaces. So closely does the occurrence of caries adhere to these locations that there appears to be a general rule governing the process. Caries is never found on the cusps of teeth or the lateral surfaces which are frequently traversed by foods in mastication unless there be a pit or crevice into which the cleansing forces of mastication do not reach. It is a very significant fact that all these locations of occurrence mentioned above are those which are protected from the excursions of food and are habitually most unclean. For instance, buccal and lingual caries do not occur on teeth that are so shaped and placed that in mastication the food passes over their entire surfaces, but are found only on surfaces from which the food is deflected either by a pronounced buccal or lingual ridge or by the inclination of the tooth to its opponent.

So, also, approximal surfaces which are in open contact with the adjacent tooth between which the food passes freely in the approximal space are seldom attacked by caries. It is further noted that when a tooth stands in a luxated position in the arch so that its buccal and lingual surfaces are presented to the adjoining teeth instead of the normal approximal surfaces, it is the former that become carious rather than the mesial or distal surfaces. From this it would appear that the occurrence and the location of caries is more dependent on the external environment of the tooth than on its inherent qualities.

Turning to the actual process of caries, its lesions have every appearance of being acid decalcifications. Quite similar disintegrations may be produced experimentally on teeth which have been covered with a protective sealing with the exception of small exposed areas and which have been subjected to the action of dilute lactic acid. This same may be obtained when such teeth are placed in saliva to which small amounts of carbohydrate are added at regular intervals and allowed to incubate for some time. Moreover, as I have demonstrated by the use of hydrogen-ion indicators, such as bromethymol-blue and methyl-red, the interior of actively carious lesions

is always acid. In the same manner it may be shown that the hydrogen-ion concentration of all saliva is nearly neutral or slightly on the alkaline side of the neutral point. Thus it appears that the acids of caries are localized products, and that in order to become effective they must be separated from the surrounding and contiguous fluids by which they otherwise would be neutralized or dissipated.

Moreover, it has been demonstrated in our laboratories that porous disks, when immersed in incubated salivas, accumulate a film or coating within from twenty-four to forty-eight hours that will make the disk impervious or semipermeable, so that acid placed on one side and alkali on the other will not neutralize one another. It would appear that by some such process as this protecting films are formed on the unclean surfaces of teeth which serve to make the action of acids possible in the presence of the antacid salivary fluids.

It is also a well-known fact that active caries spontaneously ceases to be active whenever the means of protection are removed. Beginning caries on the approximal surfaces of teeth is often permanently stopped by the removal of the approximating tooth. In this manner, the environment of the carious surface is so changed that it is no longer protected from the excursions of food and from other cleansing factors. This alone is sufficient to suspend the carious process. A similar condition also obtains in large occlusal cavities of the molars and premolars when a lateral wall of the tooth breaks out in such a manner that the masticated food traverses and mechanically scrubs the entire inner surface of the cavity. These facts are extremely significant in the study of the causes of dental caries.

Regarding the source of the acids of caries and the forces which determine their degree of concentration and of disintegrative action on the tooth, we have less definite information. The most reasonable source is from the acid fermentation of retained carbohydrates. We know that carbohydrates in incubated salivas produce relatively high degrees of acid capable of decalcifying enamel. Since we know of no other source of salivary acids capable of producing the lesions of caries, we have concluded that the process consists of a decalcification of the tooth by the acids of carbohydrate fermentation. If this be true, the production of the acids of caries must depend on two principal factors: first, the amount and the character of the carbohydrates habitually retained in the mouth available for fermentation and, second, the type of salivary micro-organisms and their ability to form acids from carbohydrates.

In regard to the first factor of acid production, it is a matter of common observation that millers and candymakers and those who eat large quantities of sweets are usually prone to rapid and extensive caries. In such cases there is a copious and ever present source of carbohydrates for an extraordinary acid fermentation which occurs to a much less degree in other persons. It is also equally true that oral uncleanliness and the presence of carbohydrates about the teeth do not always result in dental caries. On the other hand, caries frequently occurs in the cleanest mouths where the amount of residual carbohydrate is minimum. The presence of carbohydrates, then, may be said to be an influencing and often a markedly accentuating factor in many types of dental caries, but not a determining influence in all cases.

In regard to the second factor, the type of microorganisms, the recent work of Lazarus-Barlow and James[3] of England, and Roderiquez[4] and Hitchens of the Army Medical School is of great interest. These investigators claim to have found

3. McIntosh, Lazarus-Barlow, and James Lancet, 1922.

4. Unpublished. Given before the Society of American Bacteriologists, December, 1922.

in every case of caries types of organisms that have not only high acid potential but also are highly acid resistant, i. e., able to live in a high concentration of their own acids. This work is a unique study of the bacteriology of caries and opens up a new field of investigation. Heretofore, no one has been able to identify any specific organism of caries. The cultivation of mouth bacteria on highly acid media may change our conception of the process.

It is a common observation, as I have previously stated in this paper, that caries and pyorrhea do not usually occur simultaneously to the same degree; that is, a mouth may show a marked tendency to active caries or to active pyorrhea, but seldom to both. In the first instance, caries susceptibility involves acid-forming organisms and in the second, pyorrheal invasion is accomplished by a proteolytic type of organism. These observations point toward a specific type of bacterial activity as the determining influence in each case. We know, however, that both of these types of organisms may be demonstrated in practically all mouths whether carious, pyorrhetic, or free from disease. It is my opinion that it is not so much a case of specificity of bacteria as a specificity of media, ie., the oral secretions and the retained foodstuffs, which determine the life history of the bacteria, their activity, and the type of oral disease which prevails. With this concept of dental disease in mind, we may visualize the effect of diet and of nutrition on the character of salivary secretions and, in turn, on the type of predominating bacterial activity in the composite mouth flora, which if acid forming, may produce caries, if proteolytic, may give rise to gingival disturbances and pyorrhea, or which may be wholly benign.

It must be remembered, however, that there are certain other known influences which are of major importance in the determination of caries susceptibility. These are hereditary influences, and changes which come with advancement in age and disturbances of bodily health.

It is perfectly apparent that certain persons inherit a pronounced tendency toward caries or an immunity to that disease from one or both parents. From a study of the laws of familial inheritance of disease tendencies, in general we know that there is transmitted to the offspring a type of tissue or a form of metabolism that is conducive to the particular affection. In the case of caries, many interpretations may be made of the precise manner in which the carious tendencies are transferred. When we find the same types of organisms present to a less degree in the mouths of those hereditarily immune to caries that are actively engaged in the destruction of the teeth of those who have inherited a tendency to caries, we are drawn to the conclusion that the difference between these two types is a difference in environment, i. e., oral secretions and retained foodstuffs, which in one case makes for the excessive proliferation and activity of caries-forming organisms, and in the other causes no activity. This, then, involves the transference of certain types of digestion, assimilation and metabolism which, in each individual, determines the character of the oral secretions, and which in turn may determine the life history of the oral micro-organisms.

The changes which come with age are most clearly evident in the marked decrease of caries which often occurs when youths arrive at adult life. Here, also, is an opportunity for much speculation regarding the nature of the change which occurs at this time and which exerts such a profound influence on caries. In the interval during which this change takes place, there may be no appreciable alteration of the diet nor is it likely that there has been any marked decrease in the opportunity for acid fermentation. Here again, it would seem that the pivotal factor which determines the change in caries susceptibility

must be some form of metabolic readjustment occurring at this time which produces alterations in the oral secretions and in the oral bacterial activity. We know that during the period of change from adolescence to young adult life the individual undergoes many profound metabolic readjustments among which changes in salivary secretions are well within the limits of possibility.

What has been said regarding the changes of age will apply equally well to disturbances of bodily health. Here the specific instances are more sporadic and vary with the type of affection and the person, but every practitioner is familiar with cases which have suddenly become prone to caries following or concurrent with a disturbance in general bodily health. Changes in diet and nutrition or in specificity of oral bacteria will not account for these variations in caries susceptibility, but attendant changes in metabolism and oral secretion constitute at least a reasonable hypothesis for the mutations observed.

In a review of the known facts stated above concerning dental caries, into which I have inadvertently interjected some of my personal hypotheses and conclusions, we are impressed with the fact that the real essence of the problem is still unsolved. Notwithstanding all the study that has been given to it, the controlling principle which regulates the occurrence of caries has not been determined. All that we know are certain outstanding features of the process from which we can only speculate as to the nature of that which we do not understand. To no single feature of diet and nutrition, vitamins, inorganic salts, acids, hardness, proteins, carbohydrates, nor to any other principle so far considered can all forms of caries susceptibility and immunity be attributed. Neither can they be accounted for by specificity of bacteria. In view of our present knowledge, then, it would seem reasonable to conclude that caries susceptibility is determined by the more obscure fundamental characteristics of the individual, his metabolism and specific tissue reactions which preside over the oral secretions and, secondarily, over the activities of the oral microorganisms.

Accepting, for the moment, the foregoing premise, our future study of caries prevention should be to determine, first, the types of salivary secretions and state of oral hygiene which are most conducive to caries immunity, and, second, the forms of diet and nutrition and methods of oral prophylaxis that will make the individual less liable to dental caries. It must be recognized that, when dealing with the multiplicity of metabolic types and individual idiosyncrasies manifested by various types of people, no one procedure, either diet or prophylactic measure, will be equally effective in all cases. In some instances, preventive or corrective measures may be quite successful and result in a complete control of dental caries, while in others the benefits may be but partial and consist only of a reduction of the number of caries lesions. However, even though we do not have at hand the means of universal caries immunization, we should at all times make use of all the known measures which will at least tend to decrease the occurrence of that disease.

Thus far, we have at our command certain practical measures of procedure which may reasonably be considered as measures of caries prevention. Of these the following may be enumerated:

1. *The adoption of a diet that is adequate to the needs of the individual.* In general, it may be said that normal development and physical condition is conducive to health and freedom from disease. This can be attained only when at least the minimum dietary requirements are provided. These include carbohydrates, proteins, fats, vitamins, and a proportionate balance of inorganic salts, the amounts of which, as we have seen, vary with age, type of individual,

and environment. As yet, we do not fully understand the normal dietary requirements, but the principles which have thus far been established, especially the minimum requirements, should be adopted and put into practice.

2. *A reduction to the minimum of all sugars and sticky forms of carbohydrates.* If caries is the result of acid fermentation of carbohydrates, it follows that the amount of acid formed and consequently the degree of caries production must be influenced by the amount and the character of carbohydrate habitually retained in the mouth from the ingested foods. Therefore, if the diet contains only carbohydrates that are readily dislodged from the mouth and are not excessive in amount, there will be less opportunity for acid production and dental caries. There are also strong evidences that the excessive consumption of sugar is harmful in other respects. It has been suggested that a superabundance of sugars interferes with the proper metabolism of calcium. Certain it is that the overeating of sugars and candies perverts the appetite and makes the adoption of a well-balanced diet difficult.

3. *The adoption of a diet that contains a reasonable amount of hard and acid foods.* Sufficient hard foods should be ingested to give a pleasurable degree of exercise to the muscles of mastication for the purpose of stimulating normal maxillary growth. Hard and acid foods also tend to cleanse the teeth by mechanical scrubbing and by the stimulation of a copius flow of saliva to wash their surfaces. These influences make for oral cleanliness and reduce the amount of fermentable carbohydrates habitually retained in the mouth.

4. *The performance of all oral prophylactic measures which make the mouth more self-cleansing.* The smoothing of all enamel surfaces and the elimination of overhanging portions of fillings and prosthetic appliances greatly reduces the retention of foods in the mouth. The restoration of all carious teeth to their normal contours and occlusal and approximal contacts not only increases their efficiency but also provides for them to be more thoroughly cleansed by the extravasation of foods in mastication.

5. *The training of the patient to care properly for his mouth.* The simple brushing of the teeth has been shown to reduce the bacterial count over 50 per cent. The average person does not know how to cleanse his mouth properly. If he attempts to care for it regularly, he does it in a prefunctory manner and habitually misses the greater part of the tooth surfaces. It is only by personal instruction that he can be trained to cleanse thoroughly all the surfaces of his teeth. It would be well if he would adopt the methods of the Fiji Islander and the Hottentot who spend much time in scrubbing their teeth with soft sticks, by which they keep them highly polished and clean. Although strict oral cleanliness does not insure freedom from caries in all cases, it will usually serve at least to reduce the frequency of its occurrence, and it stands today as the most practical means of caries control that has yet been suggested.

CLASSIFICATION OF THE DENTAL SCHOOLS OF THE UNITED STATES

BY THE DENTAL EDUCATIONAL COUNCIL OF AMERICA

SEPTEMBER 15, 1923

Schools are listed in alphabetical sequence by states for convenience only, the order of presentation within each class having no significance.

CLASS A

University of California, Dental Department, San Francisco, California.

University of Southern California, College of Dentistry, Los Angeles, California.

Chicago College of Dental Surgery, Chicago, Illinois.

Northwestern University Dental School, Chicago, Illinois.

University of Illinois, College of Dentistry, Chicago, Illinois.

State University of Iowa, College of Dentistry, Iowa City, Iowa.

University of Louisville, College of Dentistry, Louisville, Kentucky.

Harvard University Dental School, Boston, Massachusetts.

Tufts College, Dental School, Boston, Massachusetts.

University of Michigan, College of Dental Surgery, Ann Arbor, Michigan.

University of Minnesota, College of Dentistry, Minneapolis, Minnesota.

St. Louis University School of Dentistry, St Louis, Missouri.

Washington University School of Dentistry, St. Louis, Missouri.

Creighton University, College of Dentistry, Omaha, Nebraska.

University of Buffalo, College of Dentistry, Buffalo, New York.

Western Reserve University Dental School, Cleveland, Ohio.

Thomas W. Evans Museum and Dental Institute, School of Dentistry, University of Pennsylvania, Philadelphia, Pennsylvania.

University of Pittsburgh, School of Dentistry, Pittsburgh, Pennsylvania.

Vanderbilt University, School of Dentistry, Nashville, Tennessee.

Baylor University, College of Dentistry, Dallas, Texas.

Marquette University, College of Dentistry, Milwaukee, Wisconsin.

CLASS B

College of Physicians and Surgeons of San Francisco, San Francisco, California.

University of Denver, School of Dentistry, Denver, Colorado.
(Formerly Colorado College of Dental Surgery)

Georgetown University, Dental Department, Washington, District of Columbia.

Howard University Dental College, Washington, District of Columbia.

Atlanta-Southern Dental College, Atlanta, Georgia.

Loyola University, School of Dentistry, New Orleans, Louisiana.

Tulane University of Louisiana, School of Dentistry, New Orleans, Louisiana.

University of Maryland, School of Dentistry, Baltimore, Maryland.
(Baltimore College of Dental Surgery was merged with it on June 15, 1923)

Kansas City-Western Dental College, Kansas City, Missouri.

University of Nebraska, College of Dentistry, Lincoln, Nebraska.

Ohio State University, College of Dentistry, Columbus, Ohio.

North Pacific College of Dentistry, Portland, Oregon.

Temple University Dental School, Philadelphia, Pennsylvania.
(Formerly Philadelphia Dental College)

Meharry Dental College, Nashville, Tennessee.

University of Tennessee, College of Dentistry, Memphis, Tennessee.

Medical College of Virginia, School of Dentistry, Richmond, Virginia.

CLASS C

Cincinnati College of Dental Surgery, Cincinnati, Ohio.

Texas Dental College, Houston, Texas.

CLASSIFICATION POSTPONED

Indiana Dental College, Indianapolis, Indiana.
(Classification postponed until the next meeting of the Council)

Columbia University School of Dentistry, New York, New York.
(Incorporated with the College of Dental and Oral Surgery of New York
Classification postponed until reorganization has been completed)

New York College of Dentistry, New York, New York.
(Classification postponed until the next meeting of the Council)

Ohio College of Dental Surgery, Cincinnati, Ohio.
(Affiliated with the University of Cincinnati on July 1, 1923; early complete merger in prospect)
(Classification postponed until the next meeting of the Council)

MERGED RECENTLY WITH UNIVERSITIES

Colorado College of Dental Surgery.
(Merged with Denver University, June 15, 1922)

Baltimore College of Dental Surgery, Baltimore, Maryland.
(Merged with the Dental Department of the University of Maryland, June 15, 1923)

College of Dental and Oral Surgery of New York, New York City.
(United with the School of Dentistry of Columbia University on July 1, 1923)

DISCONTINUED SINCE THE PUBLICATION OF THE CLASSIFICATION IN 1920

(1921) George Washington University Dental School, Washington, District of Columbia.

(1923) University of West Tennessee, Dental Department, Memphis, Tennessee.

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President: Olin Kirkland, Montgomery.
Secretary-Treas.: F. F. Perry, Montgomery.

Arizona—Phoenix, November, 1924.
President: H. J. Jessop, Goodrich Bldg., Phoenix.
Secretary-Treas.: Robert A. McCall, 219 Goodrich Bldg., Phoenix.

Arkansas—Ft. Smith, May 12, 13, 14, 1924.
President: F. R. Travis, Osceola.
Secretary-Treas.: Elbert Stewart, Little Rock.

Southern California—San Diego, June 24, 25, 26, 1924.
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Secretary: J. Walter Gray, 910 Union Bank Bldg., Los Angeles.
Treasurer: C. C. Noble, 510 Wright-Callender Bldg., Los Angeles.

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Secretary: B. Frank Gray, 909 Hyde St., San Francisco.
Treasurer: Robert E. Keys, 391 Sutter St., San Francisco.

Colorado—Glenwood Springs, June 19, 20, 21, 1924.
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Treasurer: William Smedley, 610 California Bldg., Denver.

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Secretary-Treas.: S. E. Armstrong, 185 Church St., New Haven.

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Secretary: D. C. Peters, Delaware Ave. & Washington Sts., Wilmington.
Treasurer: P. A. Tragnor, 807 Washington St., Wilmington.

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Secretary: W. M. Simkins, 720 Woodward Bldg., Washington, D. C.
Treasurer: Mark F. Finley, 1928 I St., N. W., Washington, D. C.

Florida—Tampa, October, 1924.
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Secretary: F. L. Adams, Bank Bldg., West Tampa.
Treasurer: C. J. Masters, Jacksonville.

Georgia—Atlanta.
President: C. C. Howard, Doctors Bldg., Atlanta.
Secretary: G. A. Mitchell, 612 Candler Bldg., Atlanta.
Treasurer: Witherspoon Wallace, Candler Bldg., Atlanta.

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Secretary: Herbert F. Wright, Pantheon Bldg., Honolulu.
Treasurer: G. R. Marsily, 303 Boston Bldg., Honolulu.

Idaho—Pocatello.
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Secretary: H. C. Coleman, Buhl.
Treasurer: W. F. Gigray, Caldwell.

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Secretary: Albert E. Converse, Leland Office Bldg., Springfield.
Treasurer: T. L. Grisamore, 29 E. Madison St., Chicago.

Indiana—Indianapolis, May 19, 20, 21, 22, 1924.
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Secretary: A. J. Kimm, 705 Citizens Bank Bldg., Evansville.
Treasurer: W. C. Hessler, Crawfordsville.

Iowa—Des Moines, May 6, 7, 8, 1924.
President: F. H. Waters, Ames.
Secretary: Earle S. Smith, 613 E. Court St., Iowa City.
Treasurer: Frank Fourt, Fairfield.

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President: C. N. Mertz, Mills Bldg., Topeka.
Secretary: C. K. Weaver, Clay Center.
Treasurer: W. T. Triplett, Salina.

Kentucky—Louisville, April 7, 8, 9, 10, 1924.
President: N. B. Smith, Frankfort.
Secretary: W. M. Randall, 1035 Second St., Louisville.
Treasurer: H. J. Patrick, Paint Lick.

Louisiana—New Orleans, March 12, 13, 14, 15, 1924.
President: S. S. Grosjean, 816 Howard Ave., New Orleans.
Secretary: F. J. Wolfe, 609 Macheca Bldg., New Orleans.
Treasurer: O. J. Ory, Garyville.

Maine—
President: L. Paul Laford, Lewiston.
Secretary: W. F. Fogg, 60 Main St., Waterville.
Treasurer: Irving E. Pendleton, Lewiston.

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Secretary: N. H. McDonald, 304 Morris Bldg., Baltimore.
Treasurer: H. A. Wilson, Calvert Bank Bldg., Baltimore.

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Secretary: W. Vernon Ryder, 175 Newbury St., Boston.
Treasurer: Joseph T. Paul, 419 Boylston St., Boston.

Michigan—Flint, April 14, 15, 16, 1924.
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Secretary: William A. Clark, 1853-55 David Whitney Bldg., Detroit.
Treasurer: E. J. Chamberlin, Ashton Bldg., Grand Rapids.

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Secretary: C. H. Turnquist, 338 LaSalle Bldg., Minneapolis.
Treasurer: T. D. Abernathy, Rochester.

Mississippi—Jackson, May, 1924.
President: W. F. Beavers, Meridian.
Secretary: A. A. Allen, Amory.
Treasurer: C. K. Bailey, Grenada.

Missouri—Excelsior Springs, May.
President: C. O. Simpson, University Club Bldg., St. Louis.
Secretary. H. C. Pollock, Metropolitan Bldg., St. Louis.
Treasurer: J. F. McLellan, Moberly.

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President: M. C. Roberts, Rialto Bldg., Butte.
Secretary-Treas.: J. E. Baker, Great Falls.

National Capital—George Washington University, First Tuesday of every month.
President: M. M. Dolmage, 825 Vermont Ave., N. W., Washington.
Secretary: Manly Michaels, 921- 15th St., N. W., Washington.
Treasurer: Walter Watts, 1401 I St., N. W., Washington.

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President: E. X. Crowley, Security Mutual Bldg., Lincoln.
Secretary: H. E. King, 546 Peters Trust Bldg., Omaha.
Treasurer: G. A. Grubb, Security Mutual Bldg., Lincoln.

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Secretary: George A. Carr, F. & M. Bank Bldg., Reno.
Treasurer: Fred J. Rulison, Reno.

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Treasurer: W. A. Young, 40 N. Main St., Concord.

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President: C. M. Dunne, Norwich.
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Secretary: F. B. Peik, Carrington.
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Treasurer: J. B. Jenkins, American Bank Bldg., Oklahoma City.

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Secretary: F. W. Hollister, 704 Journal Bldg., Portland.
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Secretary: E. C. Dye, Greenville.
Treasurer: A. H. Corley, Edgefield.

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President: J. L. Martin, Vermillion.
Secretary: C. K. Walker, Huron.
Treasurer: A. A. Wollman, Huron.

Tennessee—Chattanooga, May 5, 6, 7, 1924.
President: C. E. Byington, James Bldg., Chattanooga.
Secretary-Treas.: Joe Minor, Lambuth Bldg., Nashville.

Texas—Dallas, November 10, 11, 12, 13, 14, 1924.
President: W. O. Talbot, Fort Worth.
Secretary-Treas.: J. G. Fife, Medical Arts Bldg., Dallas.

Utah—Salt Lake City, June, 1924.
President: Ernest W. Browning, 416 Boston Bldg., Salt Lake City.
Secretary-Treas.: J. R. Calvert, Brooks Arcade, Salt Lake City.

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Secretary: Carter R. Woods, Rutland.
Treasurer: H. R. Bristol, Bennington.

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Treasurer: Peter Appel, Jr., Cheyenne.

The Journal of the American Dental Association

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Editorial

THE REAL SITUATION AMONG THE DENTISTS OF JAPAN

In our October number we called attention to the need of help for the dentists of Japan through a communication from the Department of State at Washington, and asked for contributions in the way of funds or instruments to be sent to this office. Since then more definite information has come as to the actual condition among the dental profession of Japan, and it reveals a state of affairs that must appeal to the heart of every dentist of America. In personal letters to friends in the United States, two of the leading dentists of Japan have told the story of the disaster in a very vivid way. Dr. M. Chiwaki, Dean of the Tokyo Dental College, and Dr. I. Nakahara, Dean of the Nippon Dental College, have each written authentic accounts. Dr. Nakahara's letter on *The Nippon Dental College*, with illustrations, follows this editorial. Dr. Chiwaki's letter to a personal friend in Chicago is so full of significant and interesting things that it must be largely reproduced here. Writing on November 9, he says in part:

"I believe you appreciate the fact that for more than thirty-five years I struggled with all that was within me for the dental profession in Japan. I was fortunate in being able to build up our profession to the present status. Also I was blessed with material things in a degree, and about five years ago, at the occasion of the thirty years' celebration of the establishment of our college, I donated all to the college, making it a permanent fund for the education of dentists. Now, that has been wiped out completely by the earthquake and fire.

"Our college buildings were three-story wooden structures. However, they were equipped with all modern up-to-date dental requirements and the majority of these accessories were of imported kinds. We have had very large clinics with some 120 chairs and have had

over 200 patients daily; we had an x-ray room, prosthetic, oral surgery, orthodontia departments, etc., but these were all converted into ashes and shapeless ruins.

"Our collection of various specimens in anatomical pathology, histology, and bacteriology were very rare and extensive of their kinds, numbering over 67,000. These were the fruits of fifteen years of most untiring zeal and research work on the part of Dr. Hanazawa. These, too, are gone and money can not duplicate them.

"Our library, too, was very well equipped, containing textbooks, reference books, magazines, dictionaries, charts, etc. These were not altogether in Japanese, but in English, French and German, comprising 11,000 volumes. These, also, were swept away!

"When I gave all that I had to the college, the alumni and friends of our college spontaneously started a movement to raise a fund for 500,000 yen ($250,000) in order to make a general improvement. This was oversubscribed to 680,000 yen and they were making monthly payments. Out of this amount we built an extension, a three-story concrete building, and installed all sorts of new equipments so as to accommodate ever increasing students and at the same time to give them the best dental education possible.

"Then, about two months before the earthquake, we started to raise another fund of 350,000 yen from alumni and friends. The purpose was to raise the standard of our college still higher; our aim was to elevate it either to a five or six year course. This new venture was taking a very good turn. Had it not been for this unprecedented affliction, I have no doubt in my mind that it would have gone through without much difficulty.

"Now, all these were wiped out one by one in rapid succession! The worst feature of it is that there is not hardly any prospect in sight of ever making restoration of the loss for the reason that this disaster has befallen Tokyo and Yokohama, which were the centers of our profession and, you might say, the most prosperous places in the empire. In Tokyo, Yokohama, and their vicinity, it is estimated that more than 1,000 practicing dentists were burned out. Some dentists lost their lives, some lost their families, and the rest had to flee with what they wore.

"In a private way I have done what I could with my meager means to give some relief to brother dentists, but the number is so large that it is almost fruitless for anybody to alleviate their suffering much.

"Needless to say that what America has done for Japan in this relief work is most wonderful and the public at large appreciate it deeply. It will certainly be the means to ever cement the friendship

between the two nations. Japan can not and will not forget this genuine American sympathy and help.

"Especially what the Red Cross Society has accomplished is so great and so effective that I can not tell you what great good has been done at this time of untold suffering for the masses. We hardly could realize that an organization like that could render such practical service in humane work outside of the battlefield. Really, this calamity has opened our eyes.

"However, I sincerely regret to state that the Japanese government lacks the belief in the importance of dentistry. That enormous amount of funds which was so generously contributed through the Red Cross and other channels from America and other countries has been spent and will be expended for general relief, medicine, hospital equipments, etc., leaving out the dental profession entirely. The great trouble is that those in authority lack the proper conception of oral hygiene.

"The above being the situation, there is no possible way of either alleviating the sufferings of poor dentists or restoring the dental educational institutions.

"You are well aware of the fact that dentists have to be educated. They are not born, but trained, and it takes time; say six long years, four years in college and one or two years after the college course in practical training. Unless we, the educators, provide the means to secure such an education, the oral hygiene of the Japanese nation will be set back in the future. This is the great anxiety.

"You will please pardon me if I add a few lines of my personal narrative. At the time of the earthquake, I was recuperating for a few days at a small village called Shimosoga, about fifty miles west of Tokyo. At the first shock our wooden house collapsed completely and all my family including myself were buried underneath. Fortunately, the house itself was a light wooden frame structure so that I crawled out first through thin debris and saved the rest. Mrs. Chiwaki and I were wounded a little but not seriously and were able to walk. This village, it seems, was located some fifteen miles distant from the very spot where the quake originated. Shocks were very severe. The earth cracked open and some spots fell in so badly that walking was almost impossible. At the same time fearful shocks continued ceaselessly. Traveling was full of danger. The railroad station there sank in and was buried underneath, and the rails for miles were bent and crippled altogether. On the way home, however, we were met by a relief party from our college and we were able to return to our home in Tokyo. That was just one week after the appalling catastrophe took place.

"To our great surprise, our residence was in a very fair shape, but

a still greater surprise was that we found more than thirty persons making their lodgings at our house during our absence.

"I have freely and frankly told you my present circumstances. Do you know it is very hard for a man who struggled for over one generation to accomplish a certain object, and with a great deal of sacrifice, to find all these suddenly annihilated by this terrible disaster.

"Had I been younger I might or would have smiled and said within myself, "I will do it over again, yes, and in a hundred times better shape," but at this declining age, though the spirit is willing, the physical body lacks its proper capacity. And yet, in spite of all these misfortunes and anguish, in a corner of my heart there awakens an irresistible resolution. "I must not be stopped, no nothing can ever stop me, because the cause I uphold is for the welfare of countless masses." Whether I shall succeed or not is another matter, but one thing I know, and that is, I must push onward until my very last. Such is the firm resolution which comes to my confused mind at this critical time.

"Another point of view which very closely relates to our profession and which I wish to lay before you is this: Japan learned many things from America and dentistry is one of them. From the very beginning, my endeavor has been to copy after American dentistry transplanted to Japan. This, I consider, is the height of my ambition. However, I had to struggle practically singlehanded. Law and politics, army and navy, art and literature, science and profession, industry and commerce, all these agencies of modern civilization were introduced by the government. The government's subsidiary aids did all these. In early days, these were forced upon the people by the authorities, but the dental profession alone has a different birth, for it was introduced privately and made its progress depending entirely upon private resources. It made such advancement that before the earthquake we had over 8,000 practicing dentists and seven dental colleges. The dental profession was elevating its standing in the community gradually, so that we almost reached the point of getting proper recognition by government circles and the public at large, as well as the medical profession.

"By reading these lines do not think that I am too pessimistic upon the whole situation. Far from it! I realize, however, that it is quite natural at such a time as this that the judgment of man of the strongest nerve is apt to be upset, owing to confusions and miseries which present themselves in endless form. And yet, even in my calm and cool considerations, the task of restoration is so enormous that it is almost beyond the hope of recovery by ourselves. The material resources of Japan are too poor and sadly exacted. Moreover, the destiny of our profession is very seriously arrested unless we can obtain the

assistance from America. We need America's cooperation to give immediate relief to 1,000 afflicted dentists and sufficient funds to rebuild five dental colleges which were totally destroyed by this calamity.

"I would most deeply appreciate your kind and experienced advice at this time of great crisis. I feel the need of strong guidance, which I am sure you can give me. Consider it in this way: The dental profession of America was, is, and will be the teacher to the dental profession of Japan. Your assistance will be most gratefully accepted by us all.

"The members of our teaching staff join most heartily with me in expressing our sincere gratitude for your warm sympathy, and with my best personal regards,

Very faithfully yours,

M. Chiwaki.

P. S.—If you are able to send us any old dental magazines or books, they will be most appreciated by all."

To read such an appeal as the foregoing is to move one to the highest pitch of philanthropic charity. The dentists of America simply must step into the breach and help to relieve our brothers of Japan. As Dr. Chiwaki has said, the funds so generously sent over from here under the auspices of the American Red Cross have been diverted to other channels, and the urgent rehabilament of the dental profession has been overlooked. If dentistry is to again assume the ascendancy in Japan, or if it is to keep step in the slightest approach to where it was before the disaster, then the means must come from America to give it another start. It is seldom that the world has been called upon to witness such a general wiping-out of any enterprise as has happened to the dental profession of Japan. The dentists of America have been very fortunate. No great calamity has come to check their progress, or to cripple their resources. Let us in the fullness of our hearts come to the aid of our suffering colleagues—those brave little islanders who have for years been making such a valiant attempt to build up a profession, and who have developed dentistry during recent times in a most marvelous way.

Think of it—there are more than 30,000 members in our own organization—think what we could do if each member would help in a modest way! And to the individual the sacrifice would be so small. America has never been appealed to in vain in a worthy cause, and no cause has ever been more worthy than this. Let each member before he puts this magazine out of his hand resolve that he will do his part to help these stricken people. Do not delay the matter—it requires time to get resources to Japan. Send at once either funds or instruments

or dental magazines or textbooks—old or new—to the office of the American Dental Association, No. 5 North Wabash Avenue, Chicago, Illinois,—marked, "For Japanese Relief," with your name attached, and they will be forwarded to the proper authorities in Japan. Every one of our members has a few dollars to spare—some of them have many—everyone has instruments and dental literature lying around his office. Do not lose a moment, but send them in. No matter how small the contribution, it will do untold good at this time. Let us start the year out by doing a kindly, generous, and benevolent act. Let us help Japan, and both countries will be the better for it. We shall publish the names of the donors in subsequent issues.

THE NIPPON DENTAL COLLEGE

Ichigoro Nakahara, Sc.D., President.

Tokyo, Japan, September 10, 1923.

To the Dentists of America:

What a tremendous earthquake and fire! About a hundred thousand lives were lost and over the half of the city was crushed and burnt to the ground.

Our schoolhouse, library and hospital, which had been completed after 15 years of great effort and the sum of 750,000 yen, were burnt to ashes.

The picture shows the remains of the newly built hospital.

The loss of our school, which was the one of pride among our dental world, is a great blow upon Oriental dental education.

So, I wish to build the school again but I feel sorry that I cannot do it myself as I have lost even my clothes, as well as my house.

As I believe that there is no boundary for learning, I wish to rebuild the school with the help and sympathy of our brethren.

I beseech you, therefore, to help us to carry out our purpose for the sake of the Oriental dental domain.

I shall be much obliged to you if you try to collect some contribution among your fraternity—whatever they may offer—cash, books, engine, apparatus or anything.

I must apologize for the trouble I am giving you, for which, however, you will probably excuse me, on account of the importance of the affair.

Yours truly and fraternally,

(Signed) I. Nakahara.

RUINS OF NIPPON DENTAL COLLEGE, TOKYO, JAPAN

RUSSIAN RELIEF

CALIFORNIA STATE DENTAL SOCIETY

Louis A. Burger, Oakland		$ 5.10

COLORADO STATE DENTAL SOCIETY

E. H. Taylor, Telluride		$ 2.50

FLORIDA STATE DENTAL SOCIETY

Florida State Dental Society		$ 200.00

GEORGIA STATE DENTAL SOCIETY

Dr. F. C. Wilson, Savannah		$ 50.00

ILLINOIS STATE DENTAL SOCIETY

Champaign Danville District Dental Society	$ 50.00	
*Chicago Dental Society	1,586.50	
Eastern Illinois Dental Society	50.00	
LaSalle County Dental Society	32.00	
Peoria County Dental Society	165.00	
Sangamo-Menard County Society	150.00	$2,033.50

INDIANA STATE DENTAL ASSOCIATION

Evansville Dental Society	$ 75.00	
*Hammond, Indiana dentists	50.00	
West Central Dental Society	50.00	
R. C. Day, Vincennes	1.00	
E. D. Gilford, Morganfield, Ky.	1.00	
F. A. Hamilton, Indianapolis	1.00	
R. D. Smiley, Washington	1.00	
J. C. Smiley, Washington	1.00	
R. M. Smiley, Washington	1.00	
V. W. S. Trippett, Princeton	1.00	
W. O. Trueb, Evansville	1.00	$ 183.00

MINNESOTA STATE DENTAL SOCIETY

*Minnesota State Dental Society		$ 15.00

MISSISSIPPI STATE DENTAL SOCIETY

Mississippi State Dental Society		$ 200.00

MISSOURI STATE DENTAL SOCIETY

Elmer K. Musick, Kansas City		$ 1.00

NEW JERSEY STATE DENTAL SOCIETY

Philip Nemoff, West New York		$ 5.00

NEW YORK STATE DENTAL SOCIETY

First District Dental Society	$ 500.00	
Second District Dental Society	100.00	
Washington Heights Dental Society	50.00	$ 650.00

NORTH CAROLINA STATE DENTAL SOCIETY

North Carolina State Dental Society		$ 300.00

NORTH DAKOTA STATE DENTAL SOCIETY

C. E. Johnson, Valley City		$ 5.00

OHIO STATE DENTAL SOCIETY

Cleveland Dental Society		$ 500.00

PENNSYLVANIA STATE DENTAL SOCIETY

Chester and Delaware Counties Dental Society		$ 50.00

SOUTHERN CALIFORNIA DENTAL ASSOCIATION

Southern California Dental Association	$ 600.00	
Unknown contributor from Los Angeles	2.00	$ 602.00

TEXAS STATE DENTAL SOCIETY

Dallas County Dental Society		$ 75.00	
Fort Worth Dental Society		50.00	
Grayson County Dental Society:			
C. H. Beseda, Van Alstyne	$1.00		
C. M. English, Sherman	1.00		
B. F. Gilmer, Denison	1.00		
J. E. Meador, Denison	1.00		
Max C. Murphy, Sherman	1.00		
H. T. Walker, Denison	1.00		
J. M. Weems, Sherman	1.00	7.00	
Wichita County Dental Society		50.00	
T. F. Cox, Austin		1.00	
L. C. Kleinecke, Cuero		1.00	
H. L. Pearson, Clarksville		2.00	
M. E. Sanders, Rosenberg		1.00	
A. E. Walters, Texarkana		1.00	$ 188.00

WASHINGTON STATE DENTAL SOCIETY

A. J. Low, Roslyn		$ 5.00

WISCONSIN STATE DENTAL SOCIETY

Wisconsin State Dental Society		$ 5.00
Total amount received from State Societies		$5,000.10
*Contributions paid direct to Dr. Floristan Aguilar, Madrid Spain		$2,604.00
Grand total December 18, 1923		$7,604.10

JAPANESE RELIEF CONTRIBUTIONS

*Cash Receipts	$ 135.00

DENTAL INSTRUMENTS AND SUPPLIES

*Additional instruments and supplies received: Arthur D. Barker, Ogden, Utah; Joseph G. Wiedder, Chicago, Illinois; B. R. Elliott, Medford, Oregon.

*Itemized list of contributors published in the December issue of The Journal.

Medical and Dental News

ARKANSAS

Health Pamphlets of the Arkansas Board of Health: The Arkansas State Board of Health sends each newly married couple in Arkansas a series of attractive and simply worded booklets, prepared by the board with the cooperation of the United States Children's Bureau. The Arkansas Family Series includes the following titles: 1. A New Home for Arkansas; 2. The Business of Living; 3. Prospects for Arkansas; 4. The Needs of a Baby; 5. Concerning Jean; 6. The Coming of the Baby; 7. A New Citizen for Arkansas; 8. Concerning the Baby; 9. The Child from Two to Six Years of Age.

INDIANA

New Children's Bureau Publication—Children of Preschool Age in Gary, Ind.: Part I. General conditions affecting child welfare. By Elizabeth Hughes. Part. II. Diet of the children. By Lydia Roberts. Bureau Publication No. 122, 175 pp. One of the first scientific studies of the preschool child. Part I covers community conditions, home and family conditions, housing, economic conditions, child care, and hygiene. Part II is a detailed study of diet and its relation to physical condition. A very high percentage of the children were found to be receiving inadequate diets.

This report supplements bureau publication No. 111, Physical status of preschool children, Gary, Ind., by Anna E. Rude, M.D., 84 pp. 1922.

NEW HAMPSHIRE

Traveling Dental Clinics in New Hampshire: In 1921, under the leadership of the home demonstration agent, four towns of Hillsborough County united in establishing a traveling dental clinic for children, the communities paying for equipment and the salary of the dentist and the children paying for work at the rate of $2.00 per hour. The results were so satisfactory that this year twelve towns have used the clinic, and similar clinics have been equipped in several other counties. The extension service of the University of New Hampshire, with the cooperation of school authorities, is working to arouse state-wide interest in the project.—The Granite Monthly, Concord N. H., October, 1923.

GENERAL

Reduction in Maternal Mortality, 1923: Figures of the Metropolitan Life Insurance Company indicate a considerable reduction in the deathrate for diseases incidental to pregnancy and childbirth during this year. Among white persons insured in its industrial department, the rate for the first nine months of 1923 was 17.7 per 100,000, which marks a reduction of 5.3 per cent and 9.7 per cent, respectively, over the figures for the corresponding periods of 1922 and 1921. Among the colored policyholders, the per cent reduction has been even larger.—Statistical Bulletin, Metropolitan Life Insurance Co., New York, October, 1923.

Dental Clinic: Dr. Roland H. Cranford, surgeon-in-chief and superintendent of the South Mississippi Charity Hospital, announces the opening of a dental clinic on Tuesday and Friday afternoons from 2 to 4 o'clock at the South Mississippi Charity Hospital. The same rules and regulations which govern the admittance of other patients to the hospital will be followed strictly with reference to patients applying for admission to the dental clinic. Treatments will be limited to extractions, treatments and dental surgery. This dental clinic, like the general dispensaries, will take care of a limited number compared with the great need. The dental and medical professions are kindly asked not to refer any case to the dental clinic that is not poor or needy or absolutely unable to pay for service. The Drs. Leggett will have direct control of the dental department.

Announcements

CALENDAR OF MEETINGS

NATIONAL SOCIETIES

American Dental Association, November 10, 11, 12, 13, 14, 1924, Dallas, Texas.

Association of American Dental Schools, March 5, 6, 7, 1924, Congress Hotel, Chicago, Illinois.

American Society of Dental Radiographers, January 15 and 16, 1924, Chicago, Illinois.

Dental Protective Association of the United States, 4:00 P. M., December 15, 1924, Palmer House, Chicago, Illinois.

STATE SOCIETIES

National Capital, at Washington, D. C., first Tuesday of every month.

January

Chicago Dental Society, at Chicago (17, 18, 19).
Nevada, at Reno (15).
Rhode Island, at Providence (15, 16).

February

Marquette University Dental Alumni Association, at Milwaukee, Wisconsin (20, 21, 22).
Minnesota, at St. Paul (12, 13, 14, 15).

March

Louisiana, at New Orleans (12, 13, 14, 15).
Vermont, at Burlington (19, 20, 21).

April

Alabama, at Montgomery (8).
Connecticut, at Waterbury (17, 18, 19).
Kansas, at Topeka (28, 29, 30).
Kentucky, at Louisville (7, 8, 9, 10).
Michigan, at Flint (14 15, 16).
New Jersey, at Trenton (8, 9, 10, 11).
North Carolina, at Raleigh (21, 22, 23).
Virginia, at Norfolk (28, 29, 30).

May

Arkansas, at Ft. Smith (12, 13, 14).
California State, at San Francisco (26, 27, 28, 29).
Illinois, at Springfield (13, 14, 15).
Indiana, at Indianapolis (19, 20, 21, 22).
Iowa, at Des Moines (6, 7, 8).
Maryland, at Baltimore (5, 6, 7).
Massachusetts, at Boston (5, 6, 7, 8, 9).
Mississippi, at Jackson.
Missouri, at Excelsior Springs (26, 27, 28).
Nebraska, at Lincoln (19, 20, 21, 22).
New York, at Binghamton (7, 8, 9, 10).
Pennsylvania, at Pittsburgh (13, 14, 15).
South Dakota, at Huron.
Tennessee, at Chattanooga (5, 6, 7).
West Virginia, at Huntington (19, 20, 21).

June

Colorado, at Glenwood Springs (19, 20, 21).
New Hampshire, at The Weirs (18, 19, 20).
North Dakota, at Grank Forks (15).
Southern California, at San Diego (24, 25, 26).
Utah, at Salt Lake City.
Wyoming, at Cody (16, 17, 18).

July

Wisconsin, at Milwaukee (8, 9, 10).

November

Arizona, at Phoenix.
American Dental Association, at Dallas (10, 11, 12, 13, 14).
Texas, at Dallas (10, 11, 12, 13, 14).

December

Ohio, at Columbus (4, 5, 6).

MEETINGS OF STATE BOARD OF DENTAL EXAMINERS

Delaware, at Wilmington, January 16 and 17. Secretary, W. S. P. Combs, Middletown, Delaware.

North Dakota, at Fargo, January 8 to 11. Secretary, Solon Crum, Fargo, North Dakota.

MINNESOTA STATE DENTAL ASSOCIATION

The forty-first annual meeting of the Minnesota State Dental Association will be held at the St. Paul Auditorium, St. Paul, Minnesota, February 12, 13, 14 and 15, 1924.

C. H. TURNQUIST, *Secretary*,
338 LaSalle Building, Minneapolis, Minn.

MINNESOTA STATE DENTAL ASSOCIATION ANNUAL MEETING

The Minnesota State Dental Association extends a cordial invitation to all ethical dentists to attend the forty-first annual meeting to be held in the St. Paul Auditorium, Feb. 12, 13, 14 and 15, 1924. The officers and committees have attempted to select subjects for essays and clinics that will be of vital interest, especially to the "general practitioner."

In order to concentrate fully on the various subjects under consideration, we have classified our program in such a way that an entire day is devoted to one particular phase of dentistry, or, in some instances, to several phases that are closely related. There will be two written discussions for each essay, and time will be allotted for open discussion on the various committee reports. Two half days will be devoted to general clinics, affording us the opportunity of presenting every phase of dentistry, including all the subject-matter of the various essays. One half day has been set aside for the exhibitors, and, judging from all the applications already received, a very complete and attractive display is assured.

The Minnesota State Dental Nurses and Assistants Association will hold their fourth annual meeting in the Lounge Room of the St. Paul Auditorium, Thursday, Feb. 14, 1924. An attractive and instructive program of papers and clinics has been prepared and a cordial invitation is extended to all dental nurses, oral hygienists and assistants to attend this meeting.

The Woman's Auxiliary to the St. Paul District Dental Society has arranged special entertainments and social features for the visiting ladies, so that all of our out-of-town members may bring their wives with them.

The Annual State Association Banquet will be held at the St. Paul Athletic Club, Tuesday evening, February 12, at 6:30 o'clock and will be a stag affair.

One fare and one-half as transportation rates have been arranged for from all of the surrounding states, details of which will be mailed you in our regular program.

TUESDAY MORNING, FEBRUARY 12

8:30 a. m.—Registration

9:30 a. m.—Invocation

9:35 a. m.—Address of welcome. Mayor Arthur E. Nelson, St. Paul, Minn.

9:45 a. m.—"A General Consideration of Partial Denture Construction." O. DeForest Davis, Minneapolis, Minn.

Discussed by

Chas. Wiethoff, Minneapolis, Minn.

Herbert C. Nelson, St. Paul, Minn.

11:00 a. m.—"What Constitutes the Highest Type of Service in Crown and Bridgework?" C. K. Bird, St. Paul, Minn.

Discussed by

V. D. Irwin, Duluth, Minn.

C. C. Sparrow, Minneapolis, Minn.

TUESDAY AFTERNOON FEBRUARY 12

2:00 p. m.—"Dental Education." A. W. Thornton, Dean of the Dental College, McGill University, Montreal, Que.

Discussed by

Donald J. Cowling, President of Carleton College, Northfield, Minn.

C. A. Prosser, Director of Dunwoody Institute, Minneapolis, Minn.

First business session

President's address

Report of Committee of Dental Education

Open discussion

TUESDAY EVENING

6:30 p. m.—Annual State Association Banquet

WEDNESDAY MORNING, FEBRUARY 13

9:00 a. m.—"Fetal Anatomy" R. E. Scammon, Minneapolis, Minn.

Discussed by
B. G. de Vries, Minneapolis, Minn.

10:00 a. m.—"Dietetics." Percy Howe, Boston, Mass.

Discussed by
Alfred Owre, Minneapolis, Minn.
George K. Hagaman, St. Paul, Minn.

Second business session

Reports of Committees on Ethics, Oral Hygiene, Constitution and By-Laws, Membership and Finance

Open discussion

WEDNESDAY AFTERNOON, FEBRUARY 13

2:00 p. m.—General clinics
Fixed crown and bridge clinic
Anesthesia—ethylene gas
Balanced occlusion — Monson technic
Abutment preparation and casting technic
Investing, burning out and casting
Amalgam restorations
Partial dentures
Novocain technic

THURSDAY MORNING, FEBRUARY 14

9:00 a. m.—Lecture—"Radiodontic Technic and Interpretation." Howard Raper, Albuquerque, N. Mex.

Discussed by
Henry B. Clark, St. Paul, Minn.
C. E. Conley, LeSueur, Minn.

10:00 a. m.—"Oral Surgery." Boyd S. Gardner, Rochester, Minn.

Discussed by
Carl W. Waldron, Minneapolis, Minn.
E. D. Bettenhausen, Duluth, Minn.

11:00 a. m.—Third business session
Reports of Committees on Legislation
Science, Art and Invention, Dental Economics
Open discussion
Election of officers

THURSDAY AFTERNOON, FEBRUARY 14

2:00 p. m.—"A Consideration of Porcelain in Restoring Individual Teeth." W. D. Vehe, Minneapolis, Minn.

Discussed by
Amos. S. Wells, Minneapolis, Minn.
Fred Yaeger, St. Paul, Minn.

3:00 p. m.—Exhibitors' display—stage of auditorium.

FRIDAY MORNING, FEBRUARY 15

9:00 a. m.—"Technic for Taking Full Upper Impression, Based on Applied Physics." Claude J. Stansberry, Seattle, Wash.

Discussed by
Oscar A. Weiss, Minneapolis, Minn.
George S. Monson, St. Paul, Minn.

10:00 a. m.—"A Consideration of the Anatomy of the Mandible and Adjacent Tissues as a Basis Toward Stabilizing Full Lower Dentures." Elwell Neil, Nashville, Tenn.

Discussed by
Carl H. Flagstad, Minneapolis, Minn.
G. A. Roelke, Chaska, Minn.

11:00 a. m.—Fourth business session
Unfinished business
Open discussion

FRIDAY AFTERNOON, FEBRUARY 15

2:00 p. m.—"Orthodontia as Pertaining to the General Practitioner." Max E. Ernst, St. Paul, Minn.

Discussed by
G. J. Pattison, Rochester, Minn.
W. G. Courtney, E. Grand Forks, Minn.

3:00 p. m.—General clinics
Full dentures
Dr. Stansberry's method of upper impression technic
Dr. Neil's method of lower impression technic
Dr. Schlossen's method of lower impression technic
Full denture construction—Monson technic
Full denture construction—House technic
Porcelain inlays
Porcelain jacket crown construction
Radiography
Orthodontia
Exodontia

NEW YORK SOCIETY OF ORTHODONTISTS

In order not to conflict with the meeting of the American Society of Orthodontists which meets in Kansas City, Missouri, March 18, 19, 20 and 21, 1924, the annual meeting of the New York Society of Orthodontists has been advanced two weeks and will be held Wednesday afternoon and evening, February 27, 1924, at the Hotel Vanderbilt, Park Avenue and 34th Street, New York, N. Y.

WILLIAM C. FISHER, *Secretary*,
501 Fifth Avenue, New York, N. Y.

DENTAL PROTECTIVE ASSOCIATION ELECTION OF OFFICERS

The annual meeting of the Dental Protective Association of the United States was held at the Palmer House, Chicago, Illinois, December 17, 1923, at 4:00 P. M. There was a large number of members of the organization present. The Board of Directors and officers were elected for the ensuing year and other business of importance was transacted. The officers elected are as follows:

J. G. REED, *President,*
DON M. GALLIE,
Vice-President and Treasurer,
E. W. ELLIOT, *Secretary.*

ALUMNI CLINIC

The University of Iowa College of Dentistry Alumni Clinic will be held at Iowa City, Iowa, February 22 and 23, 1924.

F. B. WHINERY, *President.*
RAY V. SMITH, *Secretary.*

PHILADELPHIA DENTAL COLLEGE ALUMNI SOCIETY

The annual meeting of the Alumni Society of the Philadelphia Dental College (Temple University) will be held on Wednesday, April 16, 1924, in the College building at eighteenth and Buttonwood Streets, Philadelphia.

Notices of program will be mailed to members. Reunion of classes will be held, but the details of this will be attended to by the committees of the respective classes having it in charge.

All members of the Alumni Society are invited to attend.

ANDREW J. SEELER, *President.*
LEON A. HALPERN, *Secretary,*
2461 33rd Street.

ASSOCIATION OF AMERICAN DENTAL SCHOOLS

The meeting of the Association of American Dental Schools will be held at the Congress Hotel, Chicago, on March 5, 6 and 7, 1924. A detailed program will be published in the February issue of the Journal.

DELOS L. HILL, *Secretary.*

SOUTHWESTERN SOCIETY OF ORTHODONTISTS

The fourth annual meeting of the Southwestern Society of Orthodontists will be held at the Hotel Raleigh, Waco, Texas, Thursday, Friday and Saturday, January 24, 25 and 26, 1924. Arrangements are being made that will assure a good program. All those interested in orthodontia are cordially invited to attend. Please notify Dr. P. G. Spencer, Secretary, 1408 Amicable Building, Waco, Texas, and reservations will be made for you.

NEW BOOKS RECEIVED FOR THE LIBRARY OF THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

The Journal of the American Dental Association promptly acknowledges herewith the receipt of new publications. Books selected from those named on this list are reviewed below. Reviews are matter-of-fact statements of the nature and contents of the publication referred to and are intended *solely to guide possible purchasers.*

"Oral Hygiene." J. Sim Wallace, D.Sc., M.D., L.D.S. Lecturer on Preventive Dentistry, King's College Hospital, London. 83p., Bailliere, Tindall and Cox, London, England. Price, 5s.

"The Medical Department of the United States Army in the World War. Vol. 5. Military Hospitals in the United States. Prepared under the direction of Maj. Gen. M. W. Ireland, M.D., Surgeon General of the Army, by Lieut. Col. Frank W. Weed, M.C., U. S. Army. 857 p., 204 illustrations. Government Printing Office, Washington, D. C., $2.25.

"Manual of Chemistry." W. Simon, Ph.D., M.D., and Daniel Base, Ph.D. 12th edition, revised. 667 p., 55 illustrations, and 7 coloured plates. Lea & Febiger, Philadelphia and New York.

"Essentials of Operative Dentistry." W. Clyde Davis, A.M., M.D., D.D.S. 4th edition, revised. 363 p. 261 illustrations. C. V. Mosby Company, St. Louis, $6.50.

"Essentials of Oral Surgery." Vilray Papin Blair, A.M., M.D., F.A.C.S., Professor of Oral Surgery, Washington University Dental School, St. Louis, etc., and Robert Henry Ivy, M.D., D.D.S., F.A.C.S., Professor of Maxillo-Facial Surgery, Graduate School of Medicine, University of Pennsylvania, Philadelphia, etc. 526 p., 335 illustrations. C. V. Mosby Company, St. Louis, $6.50.

"Radiodontia (Dental Radiography and Diagnosis) Questions and Answers. Howard Riley Raper, D.D.S. 192 p., 52 illustrations. Dental Items of Interest Publishing Co., Brooklyn, N. Y.

"Chemistry for Dental Students, Vol. 1, Qualitative Analysis and Dental Metallurgy; Vol. 2, Organic and Physiological Dental Chemistry." H. Carlton Smith, Ph.G., Assistant Professor of Dental Chemistry, Harvard University Dental School, and Rachel M. Smith, A.B. Vol. 1, 186 p., 20 illustrations, $2.50. Vol. 2, 320 p., 26 illustrations, $3.50. John Wiley & Sons, Inc., New York, N. Y.

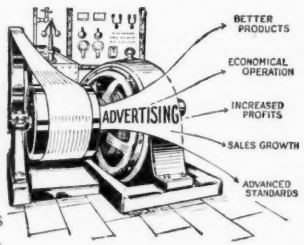
THE GENERATOR OF IDEAS

By EARNEST V. MADISON

Advertising intensifies human activity.

It creates within us the desire for better living, better products, better work. It awakens *ambition;* and ambition develops *ideas.*

As a writer has expressed it: "The most impressive and complete proof which can be asked of the tremendous power and immense value of advertising is the fact that the business standing of nations corresponds closely to their use of commercial and industrial publicity."



Advertising is *education.* The publicity given to the progress in manufacturing, growing, selling, distribution, etc., is our best insurance against inertia. It is our national stimulant toward *improvement.*

This is why the United States, a nation hardly 200 years old, is one of the two leading exporting and manufacturing nations of the world, notwithstanding that its wages of labor and standards of living are higher than in any other country.

We offset the competition of cheaper labor in other countries by inventing labor saving machines and systems. We neutralize the long established prestige of the foreign manufacturer by exporting a product which is either so modern that the foreign producer cannot imitate it or which is a far better product than he can make.

*****

Let us bring the above truths home to ourselves—*inversely.* If advertising is a force for progress isn't it to our advantage to use it? *Will it not bring us ideas?*

Our advancement is regulated by two forces—our initiative and the rapidity and extent that our mind broadens with new ideas. These ideas are obtained through text books, editorial pages of our dental papers, attendance at conventions, talks with men of our profession, and through reading the advertisements in our dental papers.

In the advertising section of this issue of The Journal of the American Dental Association will be found many ideas pertaining to modern developments in the dental field. Let your mind assimilate these new ideas. The reading of the advertisements in this paper is a habit that will both clear and extend the *routes of thought.*